US010709306B2

(12) **United States Patent**
Lee

(10) **Patent No.: US 10,709,306 B2**
(45) **Date of Patent: Jul. 14, 2020**

(54) **CLEANER AND CONTROL METHOD THEREOF**

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventor: **Changjun Lee**, Seoul (KR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **15/235,191**

(22) Filed: **Aug. 12, 2016**

(65) **Prior Publication Data**

US 2017/0042401 A1 Feb. 16, 2017

(30) **Foreign Application Priority Data**

Aug. 12, 2015 (KR) 10-2015-0114059

(51) **Int. Cl.**
A47L 11/30 (2006.01)
A47L 11/40 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A47L 11/302*** (2013.01); ***A47L 1/02*** (2013.01); ***A47L 11/085*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC A47L 11/30; A47L 11/302; A47L 11/305; A47L 11/307; A47L 11/4013; A47L 11/4016; A47L 11/4019; A47L 11/4022; A47L 11/4027; A47L 11/4038; A47L 11/408; A47L 11/4083; A47L 11/4088; A47L 1/02; A47L 1/15; A47L 11/065;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,893,037 A 7/1959 Strong
4,667,364 A * 5/1987 Meili A47L 11/293 15/319
(Continued)

FOREIGN PATENT DOCUMENTS

CN 2817718 9/2006
CN 202341952 7/2012
(Continued)

OTHER PUBLICATIONS

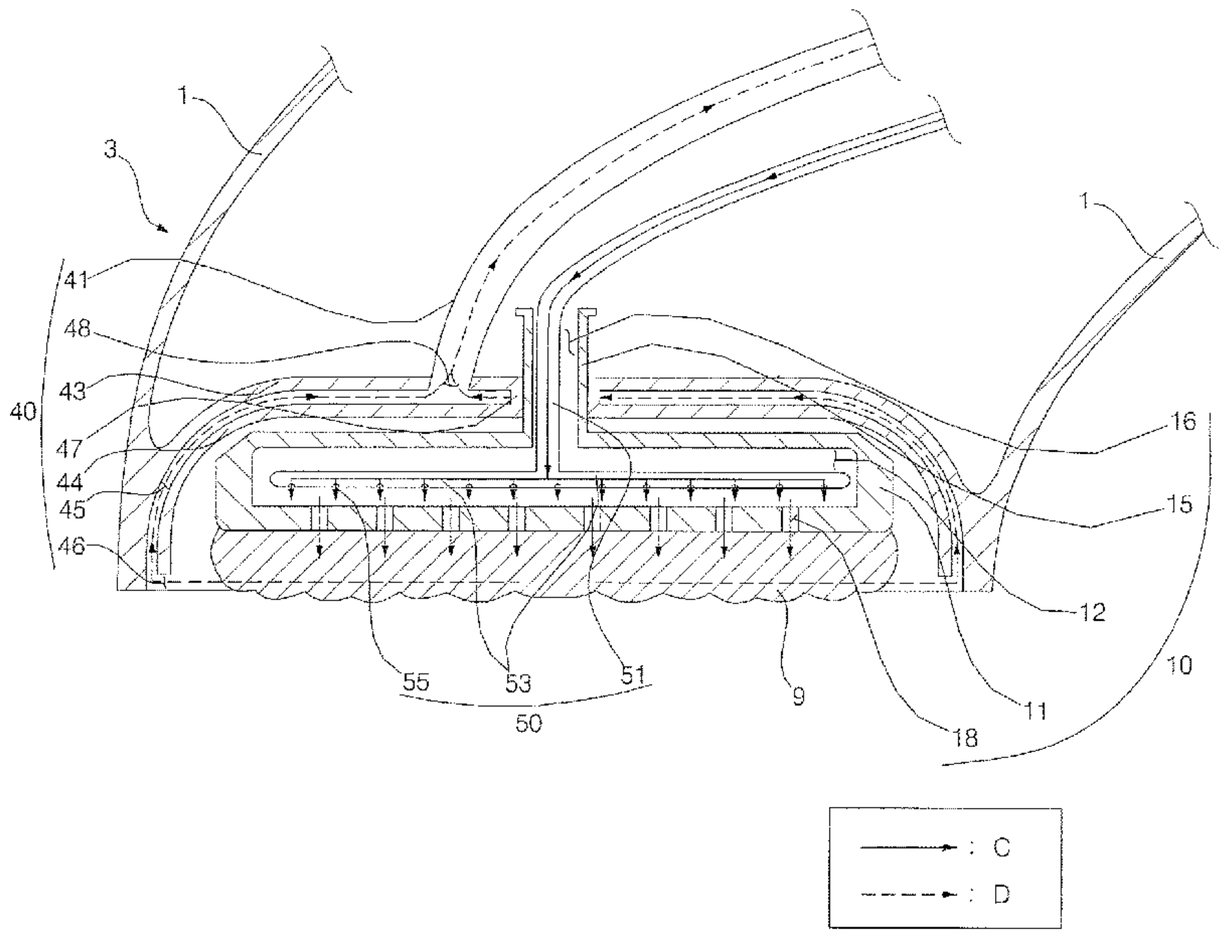
Machine Translation of KR 10-0582285, May 2006. (Year: 2006).*
(Continued)

Primary Examiner — David G Cormier
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

Provided are a cleaner having a circulation system of collecting water used in damp cloth, filtering the same, and supplying the filtered water to the cloth, and a control method thereof. The cleaner includes a storage unit storing water, a collecting unit intaking water used in a cloth and introducing intaken water to an upper side of the storage unit, a filter unit filtering water collected by the collecting unit, a water supply unit allowing water within the storage unit to flow out from a lower portion of the storage unit so as to be supplied to the cloth, a vacuum motor operated to cause water to be intaken to the storage unit through the collecting unit, and a pump operate to allow water to be transferred through the water supply unit.

17 Claims, 14 Drawing Sheets



(51) **Int. Cl.**

A47L 11/08	(2006.01)
A47L 11/202	(2006.01)
A47L 11/206	(2006.01)
A47L 1/02	(2006.01)

(52) **U.S. Cl.**

CPC ***A47L 11/2025*** (2013.01); ***A47L 11/2065*** (2013.01); ***A47L 11/4008*** (2013.01); ***A47L 11/4011*** (2013.01); ***A47L 11/4013*** (2013.01); ***A47L 11/4019*** (2013.01); ***A47L 11/4022*** (2013.01); ***A47L 11/4027*** (2013.01); ***A47L 11/4038*** (2013.01); ***A47L 11/4069*** (2013.01); ***A47L 11/4083*** (2013.01); ***A47L 11/4088*** (2013.01)

(58) **Field of Classification Search**

CPC A47L 11/085; A47L 11/125; A47L 11/145; A47L 11/16; A47L 11/161; A47L 11/162; A47L 11/1625; A47L 11/164; A47L 11/22; A47L 11/24; A47L 11/26; A47L 11/28; A47L 11/282; A47L 11/283; B08B 1/00; B08B 1/001; B08B 1/002; B08B 1/003; B08B 1/006; B08B 1/04; B08B 3/02; B08B 3/024; B08B 15/04; B08B 2203/0229; B08B 2215/00; E01H 1/053; E01H 1/10; E01H 1/101; E01H 1/103

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,331,713	A *	7/1994	Tipton	A47L 11/305 15/320
5,636,402	A *	6/1997	Kubo	A47L 11/03 15/319
6,102,052	A *	8/2000	Versteijnen	B08B 9/08 134/100.1
8,161,595	B1	4/2012	Wilson	
2005/0235453	A1 *	10/2005	Vankouwenberg	A47L 11/201 15/340.4
2006/0027253	A1 *	2/2006	Kaiser	B08B 3/026 134/94.1
2010/0192980	A1	8/2010	Turner	
2012/0233804	A1 *	9/2012	Studebaker	A47L 11/161 15/322

FOREIGN PATENT DOCUMENTS

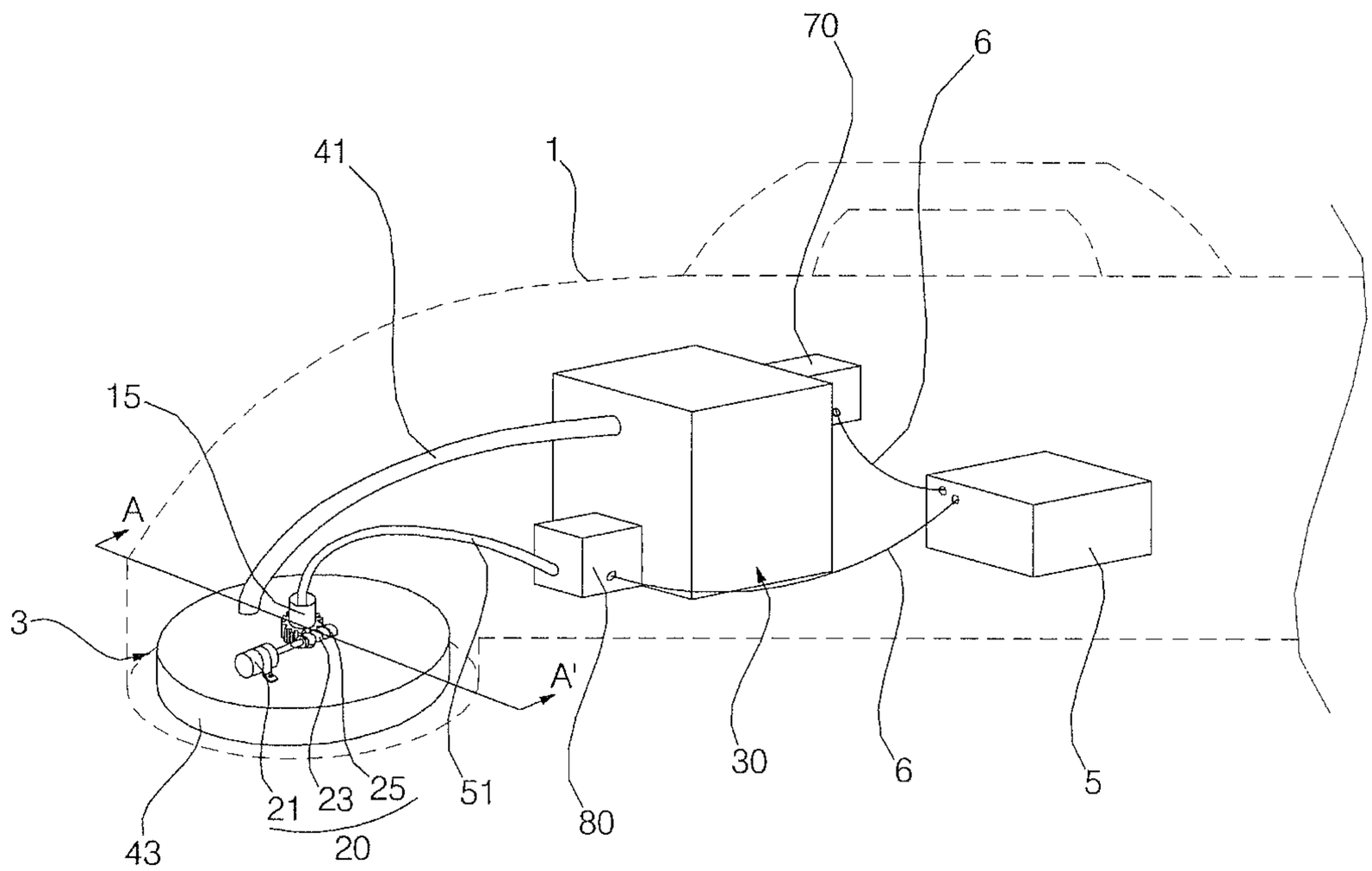
CN	203436286	2/2014
DE	8512858 U	8/1987
JP	2005-342420	12/2005
KR	10-0582285	5/2006
KR	10-2014-0146702	12/2014
TW	240442	2/1995
TW	201318592	5/2013
TW	M469037	1/2014
WO	20070063452	6/2007

OTHER PUBLICATIONS

Extended European Search Report in European Application No. 16183860.2-1712, dated Jan. 5, 2017, 7 pages (with English translation).

* cited by examiner

FIG. 1



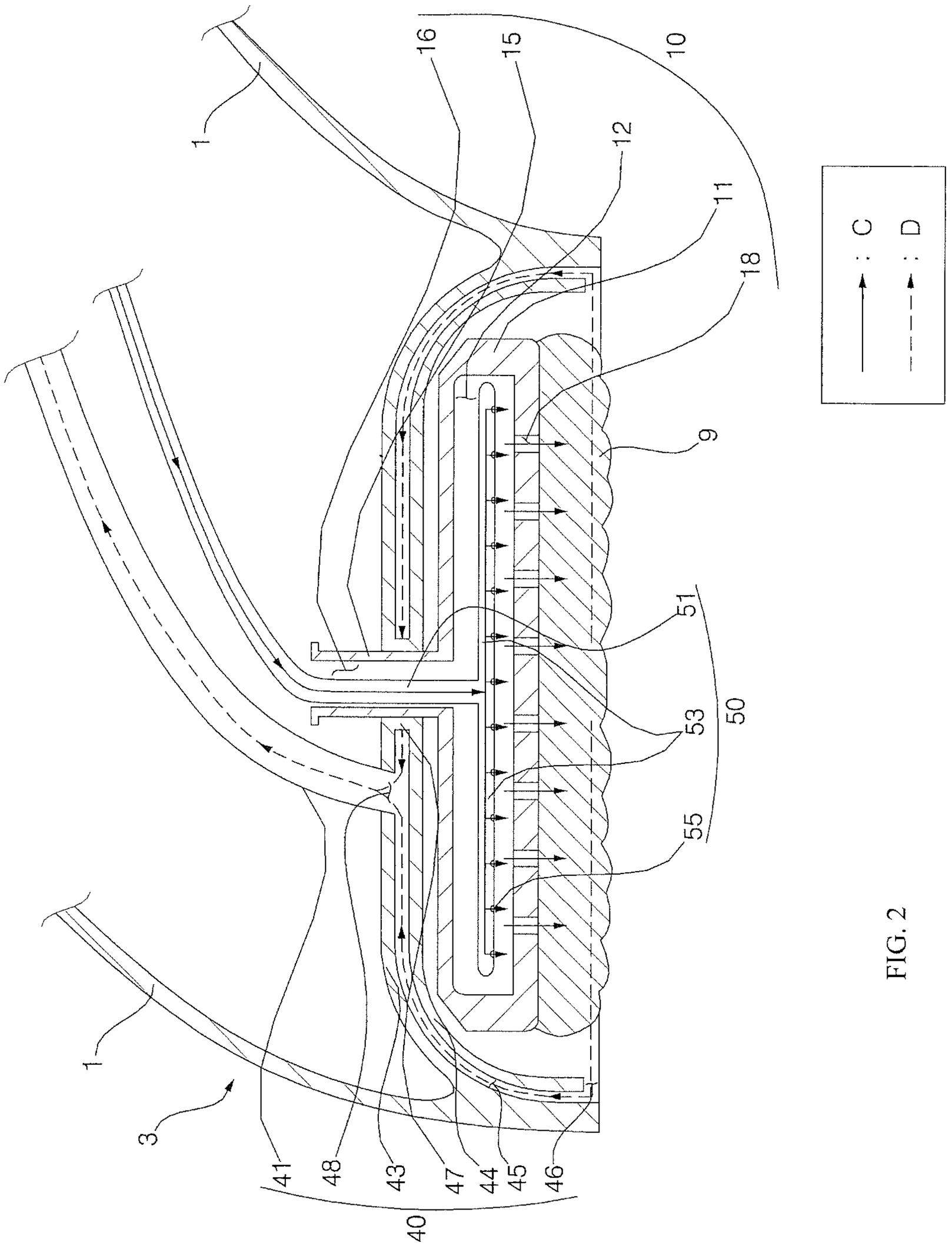


FIG. 2

FIG. 3

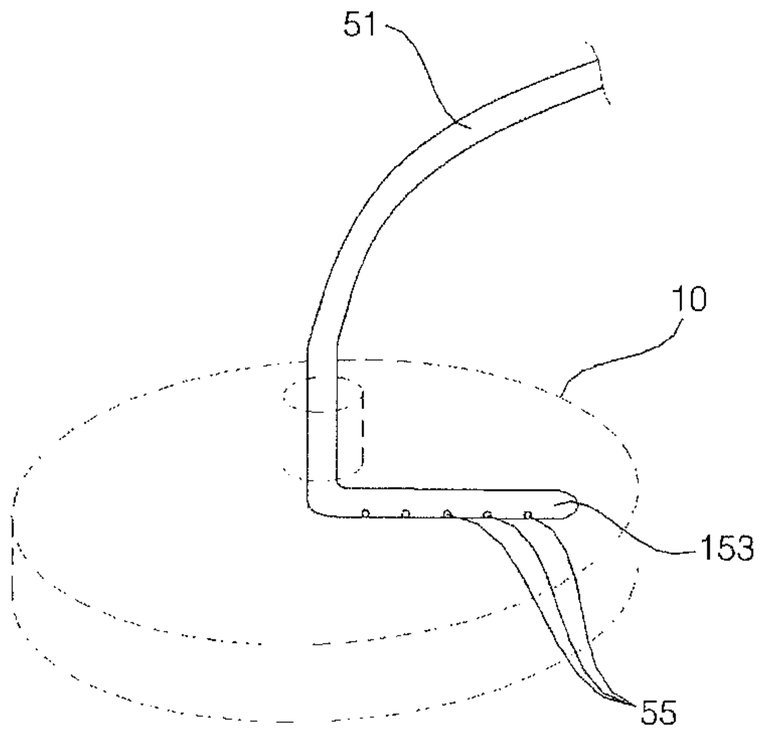


FIG. 4

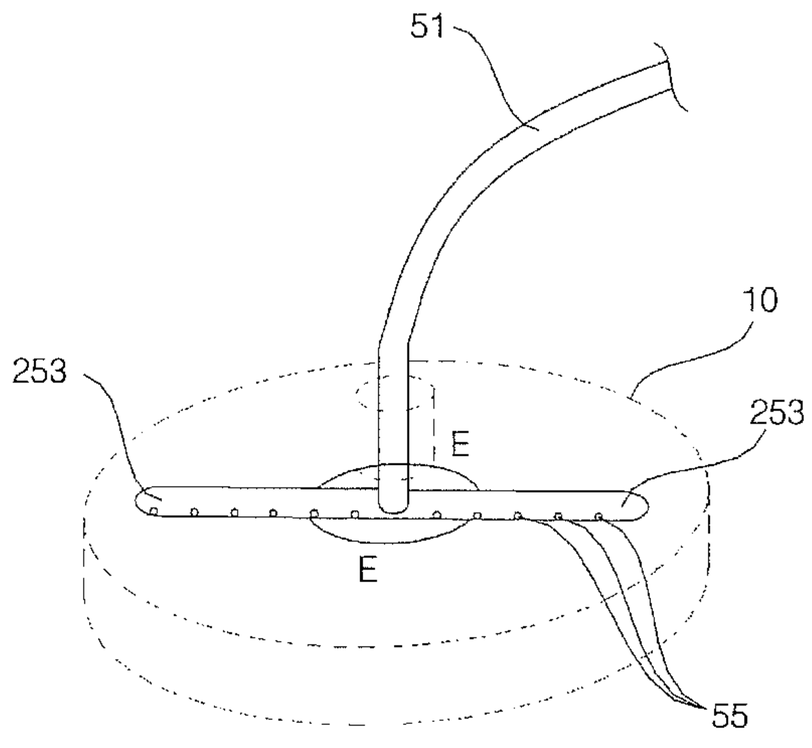


FIG. 5

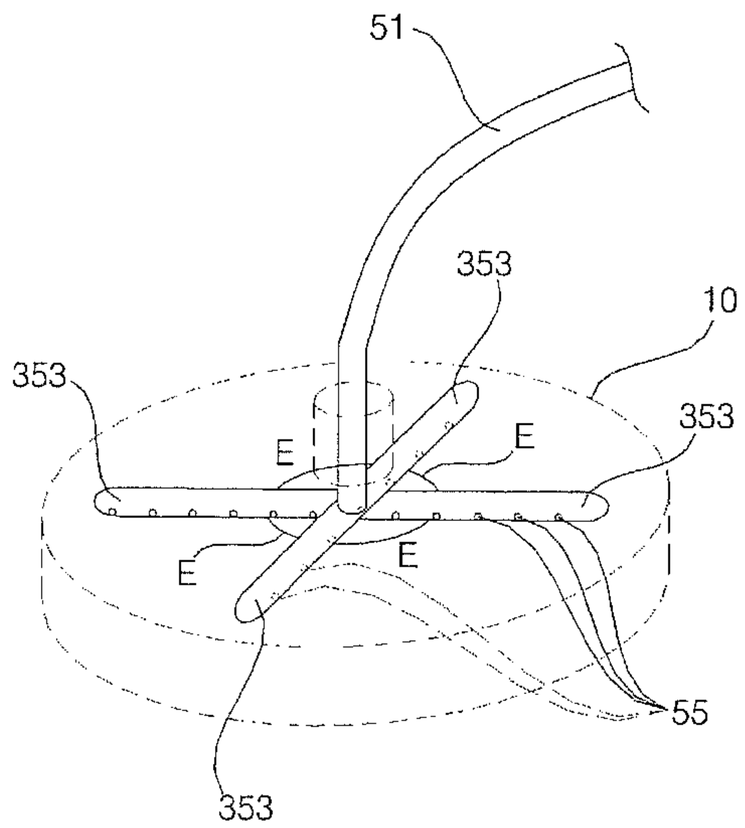


FIG. 6

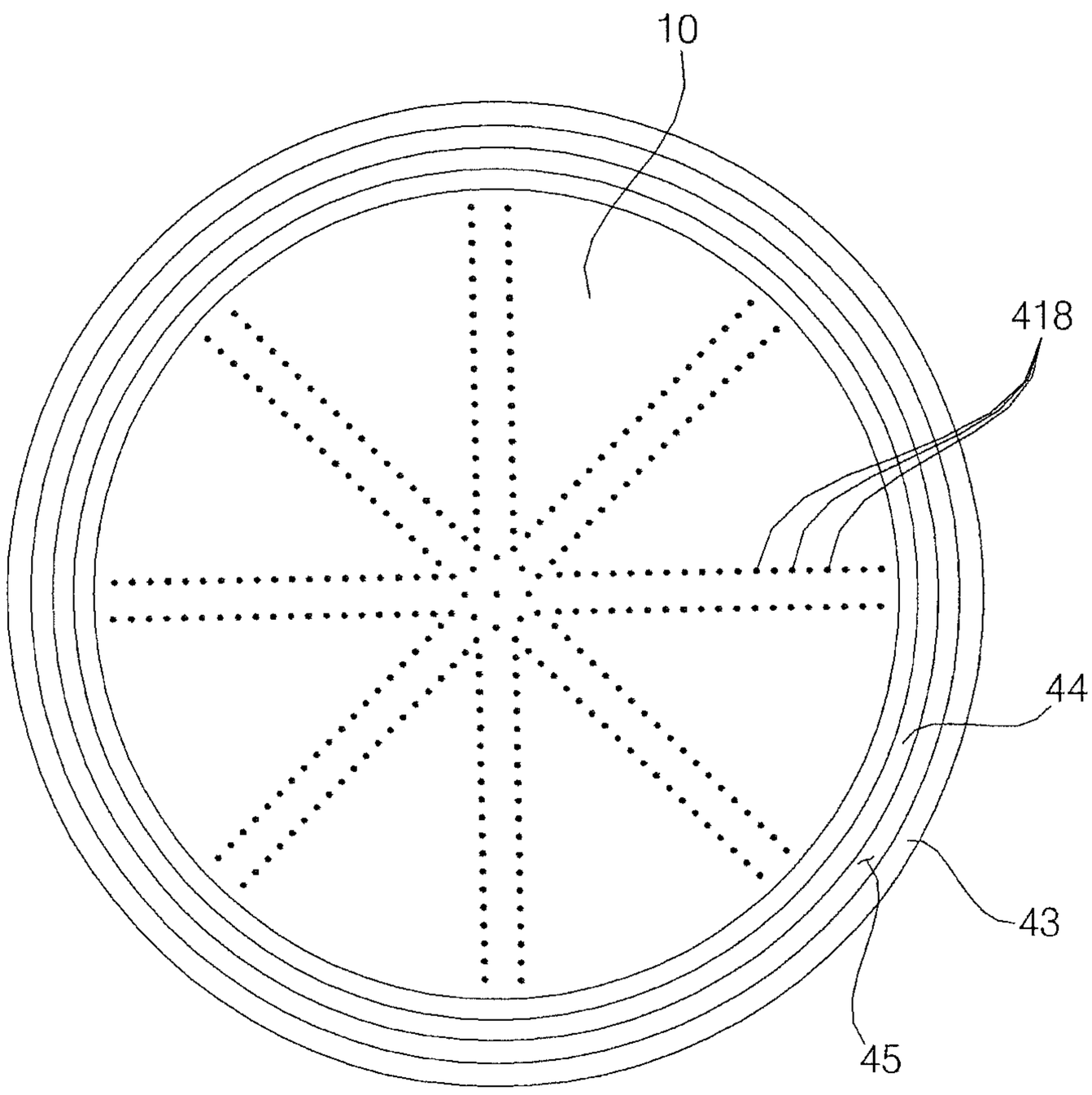


FIG. 7

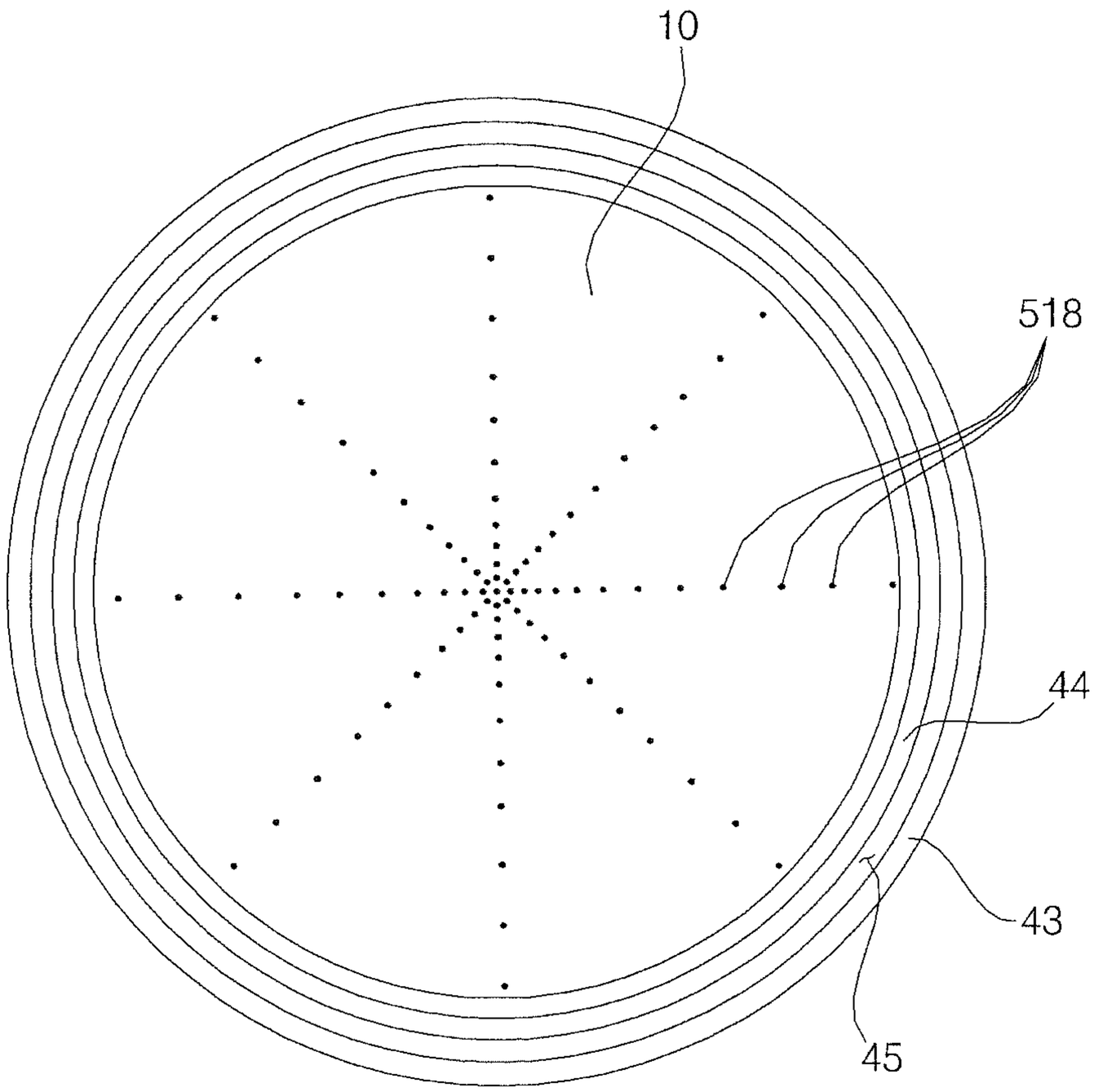


FIG. 8

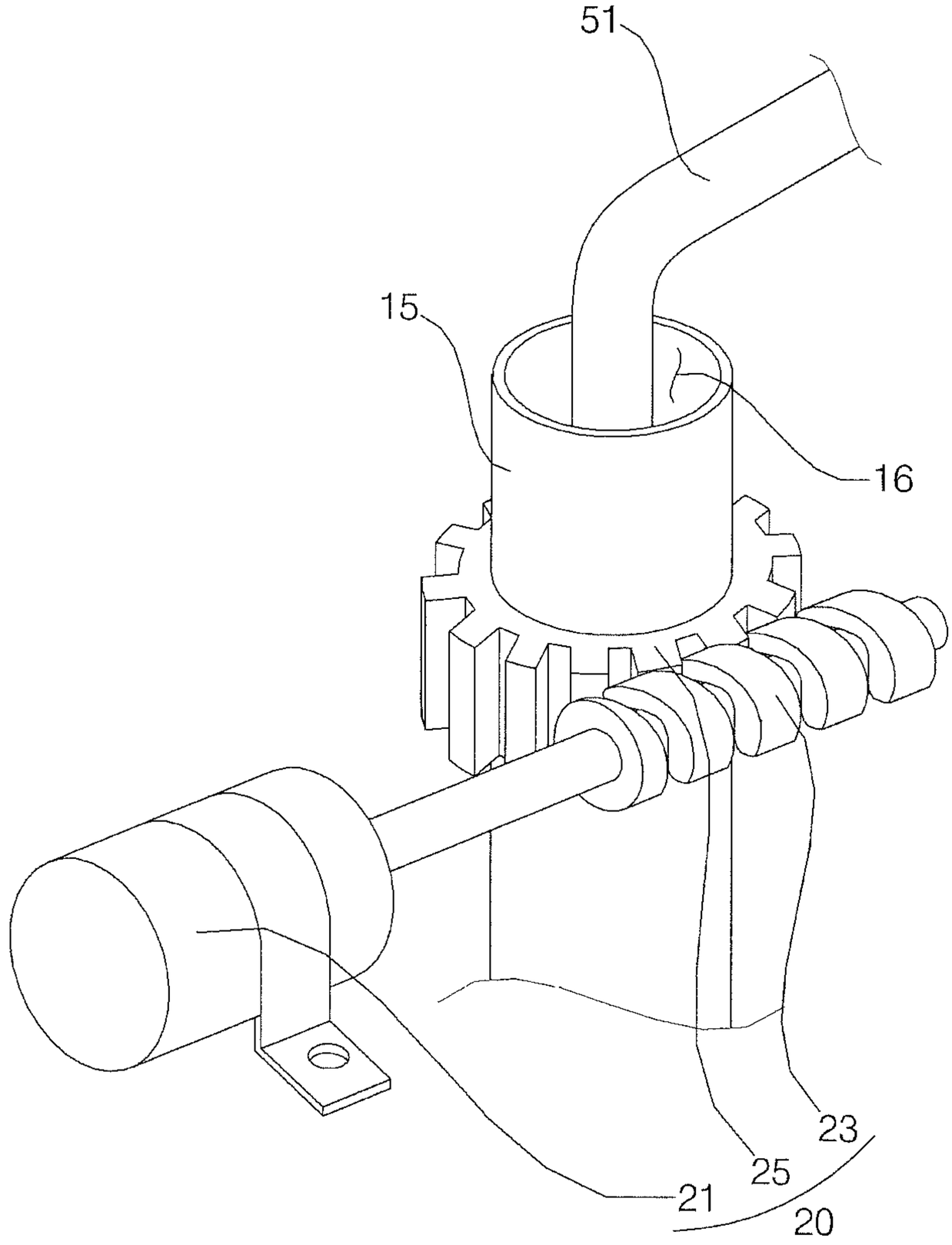


FIG. 9

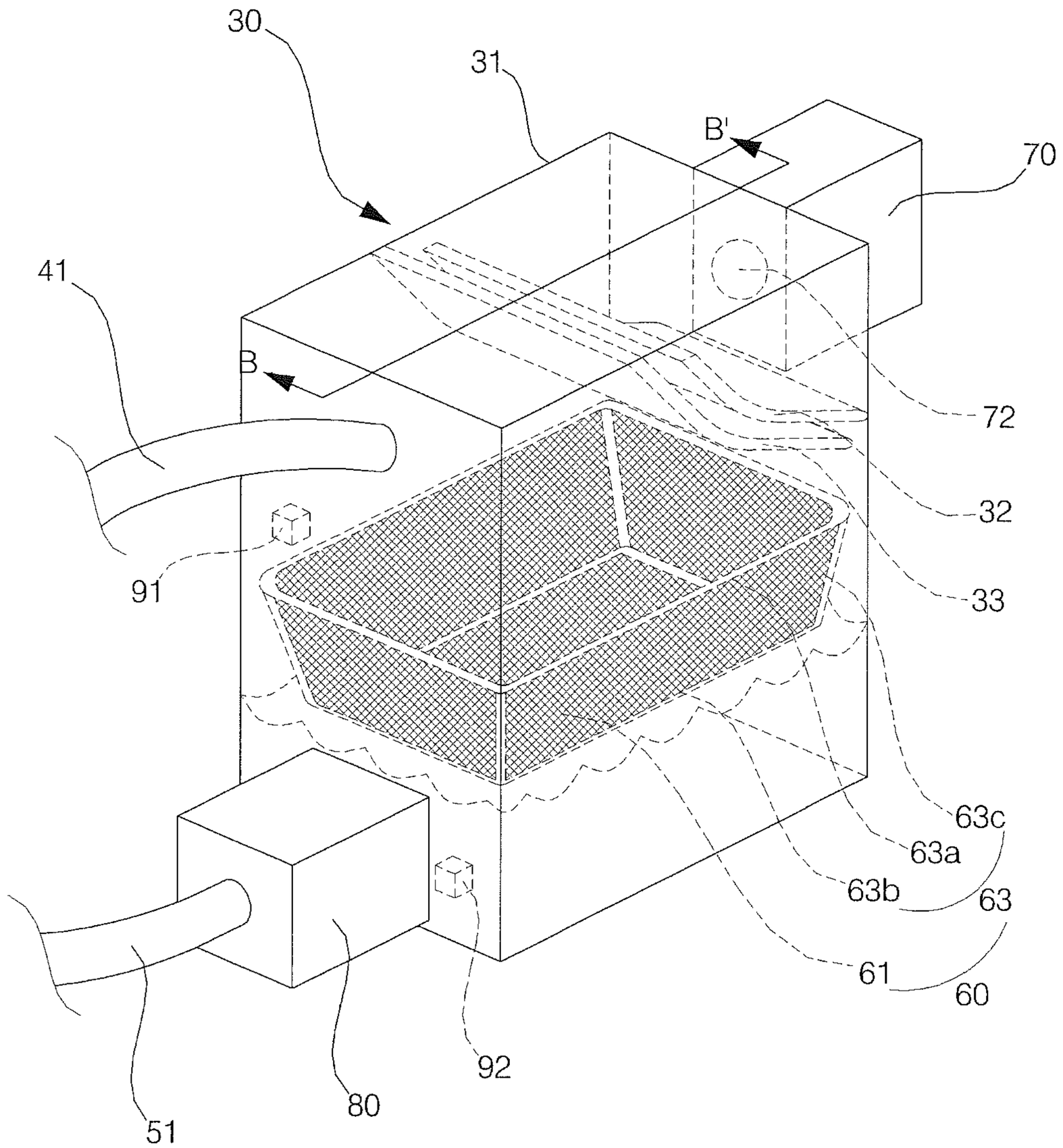


FIG. 10

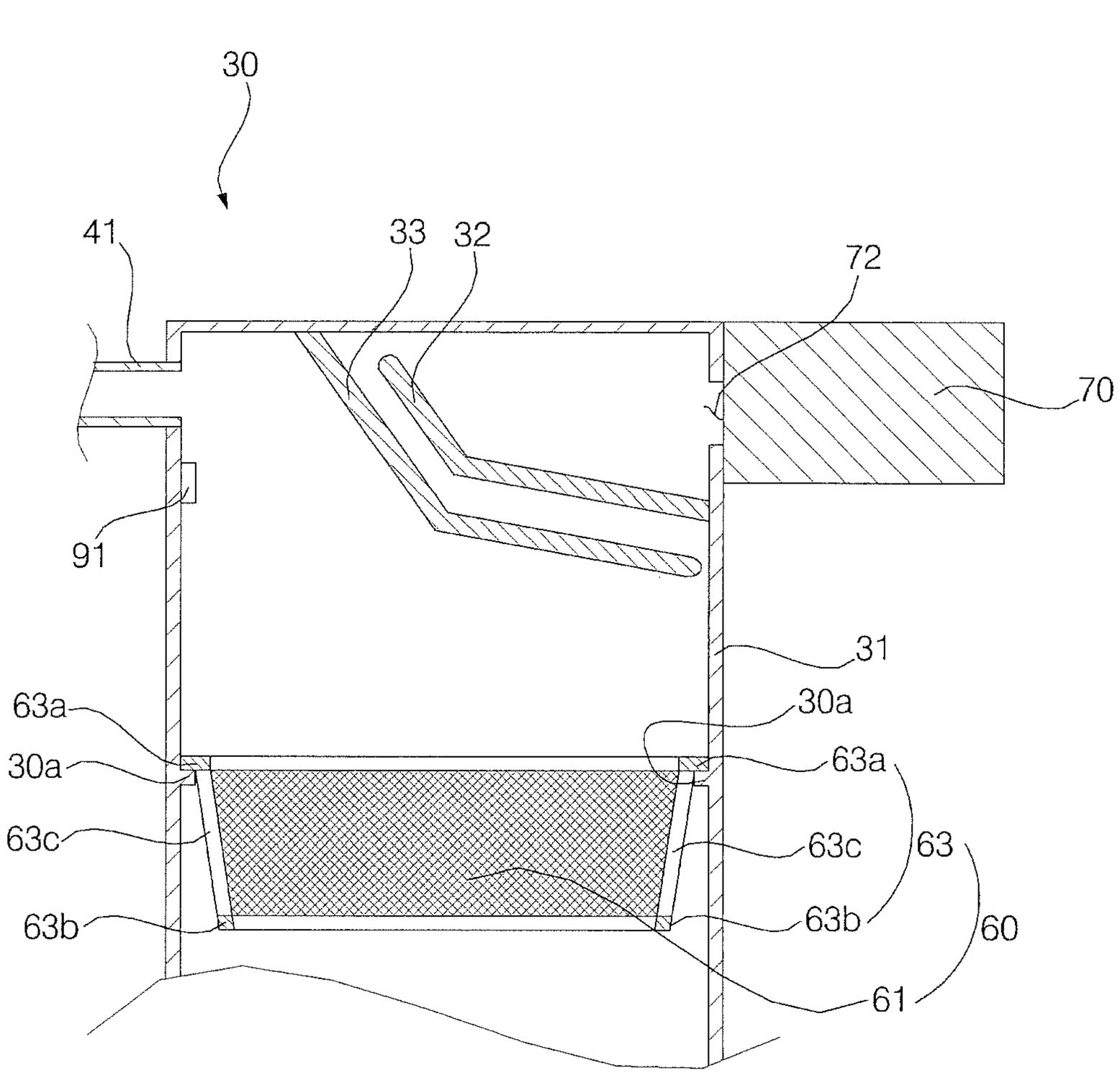


FIG. 11

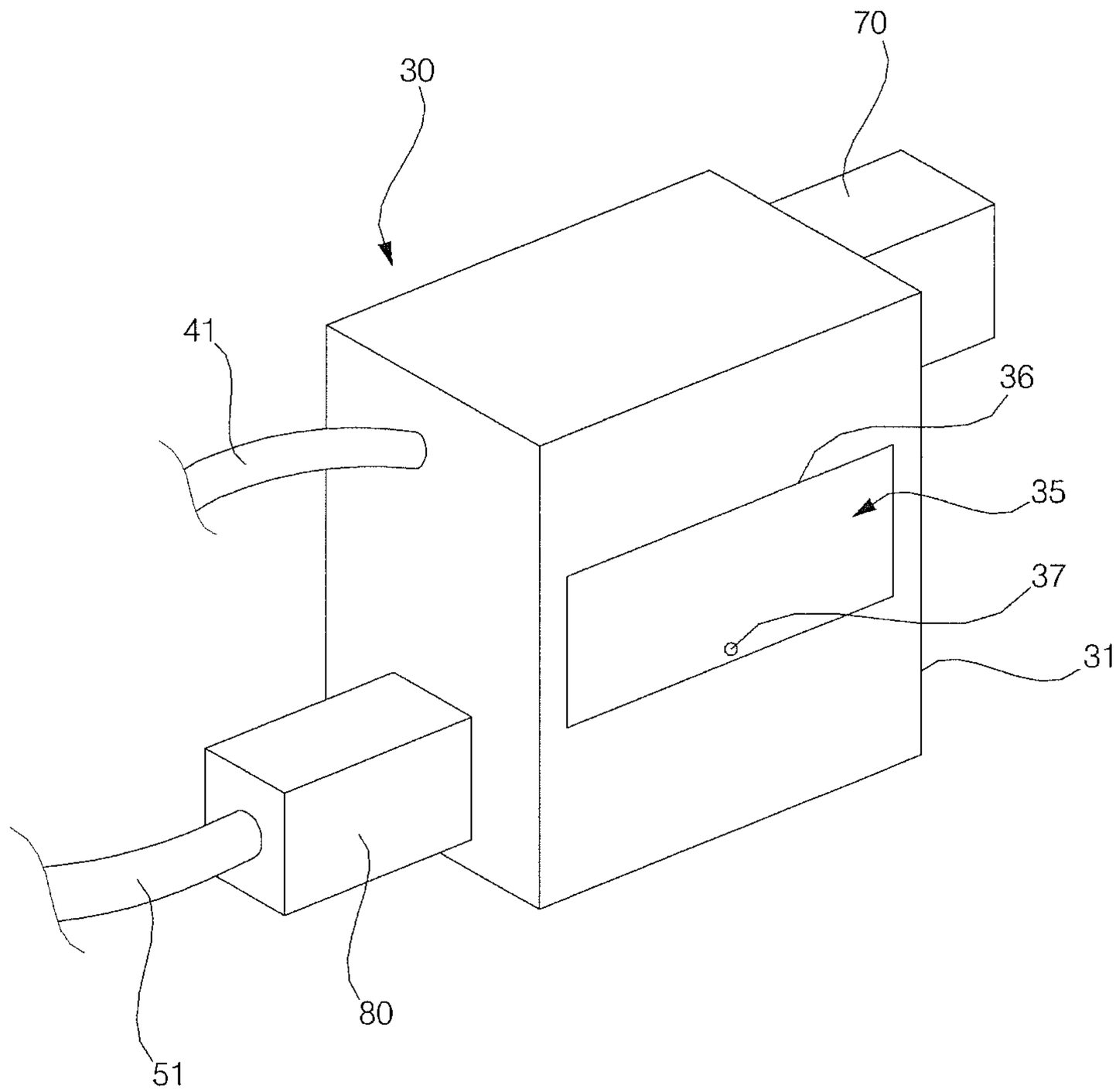
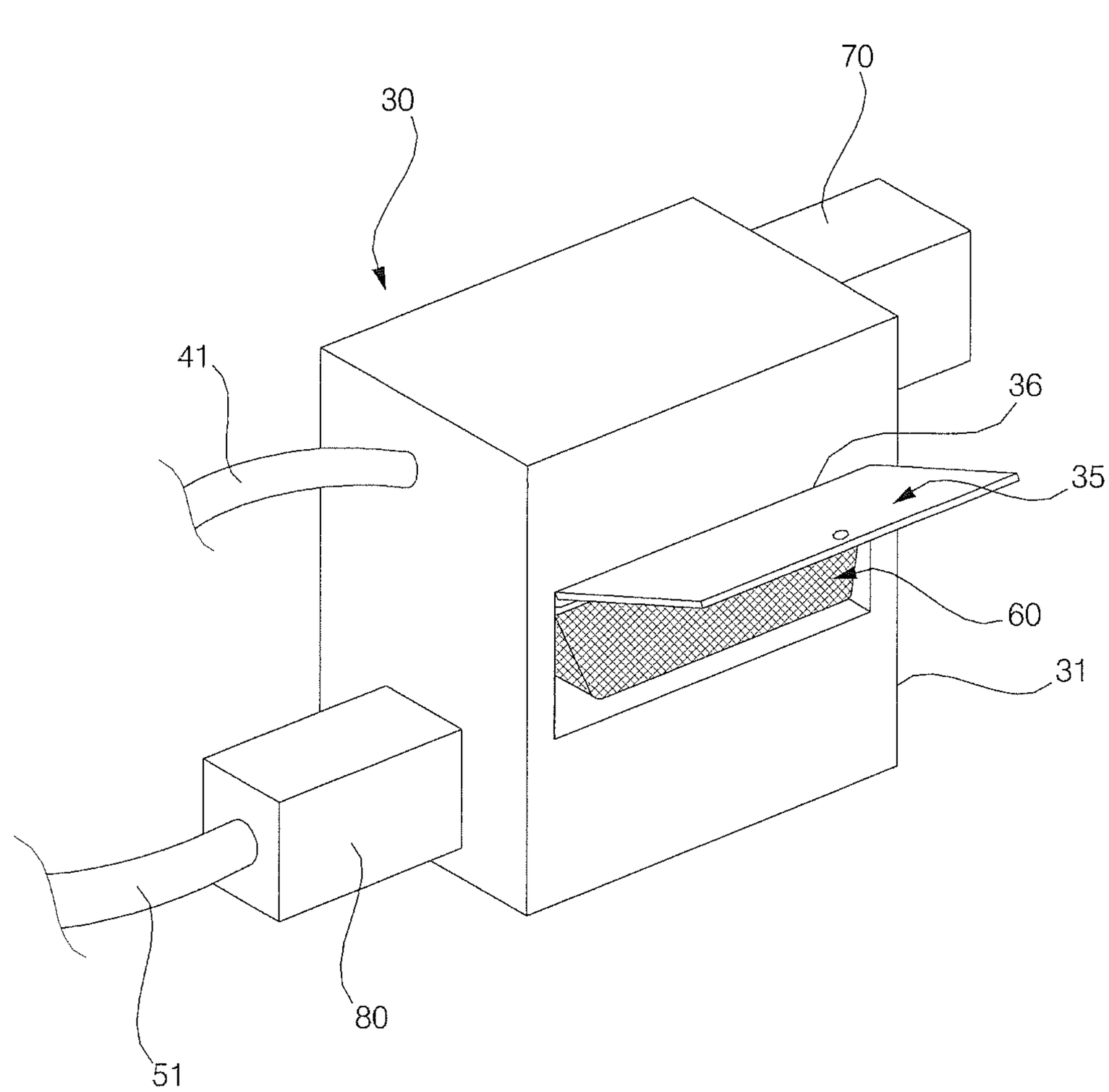


FIG. 12



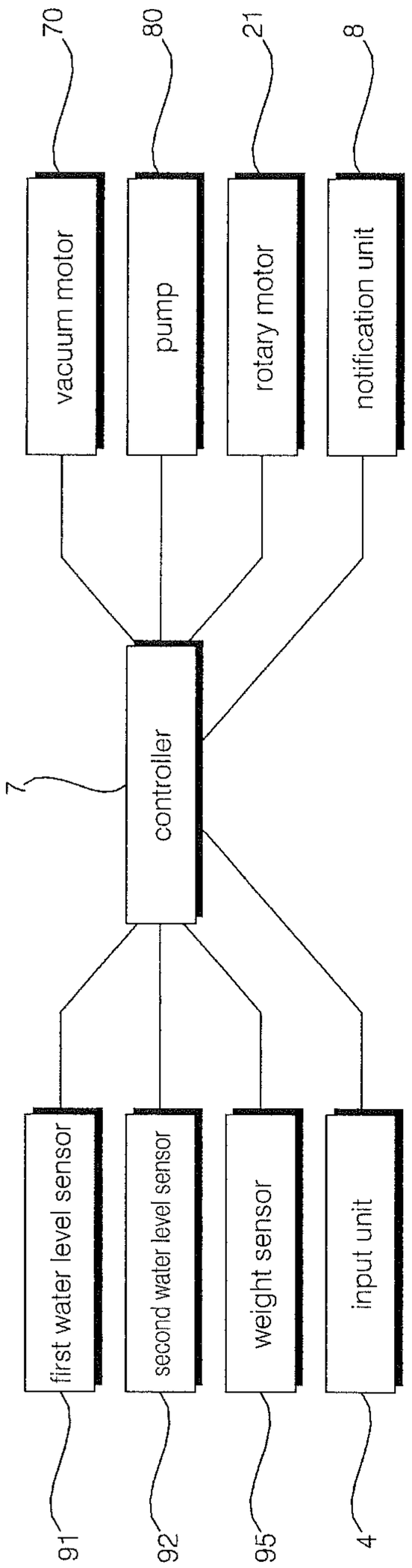

70
80
21
8
vacuum motor
pump
rotary motor
notification unit
7
controller
first water level sensor
second water level sensor
weight sensor
input unit
91
92
95
4

FIG. 13

FIG. 14

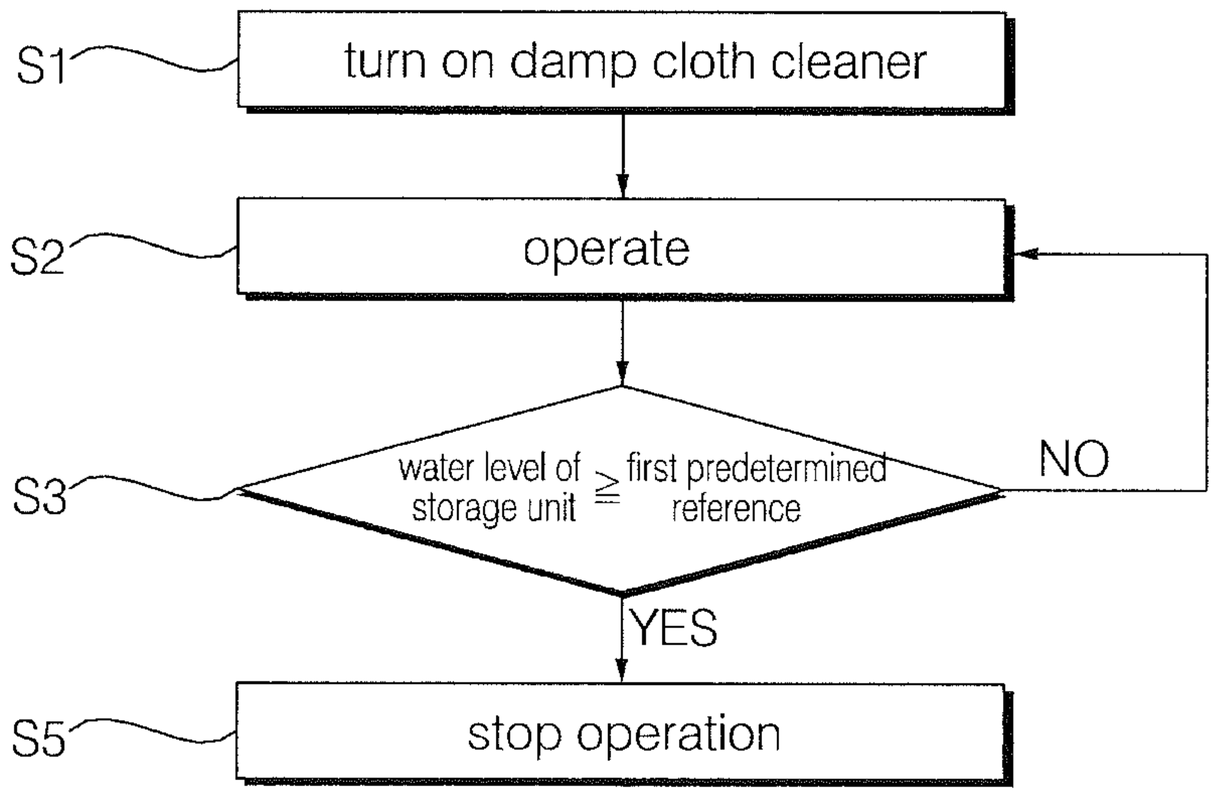

S1
turn on damp cloth cleaner
S2
operate
S3
water level of storage unit ≥ first predetermined reference
NO
YES
S5
stop operation

FIG. 15

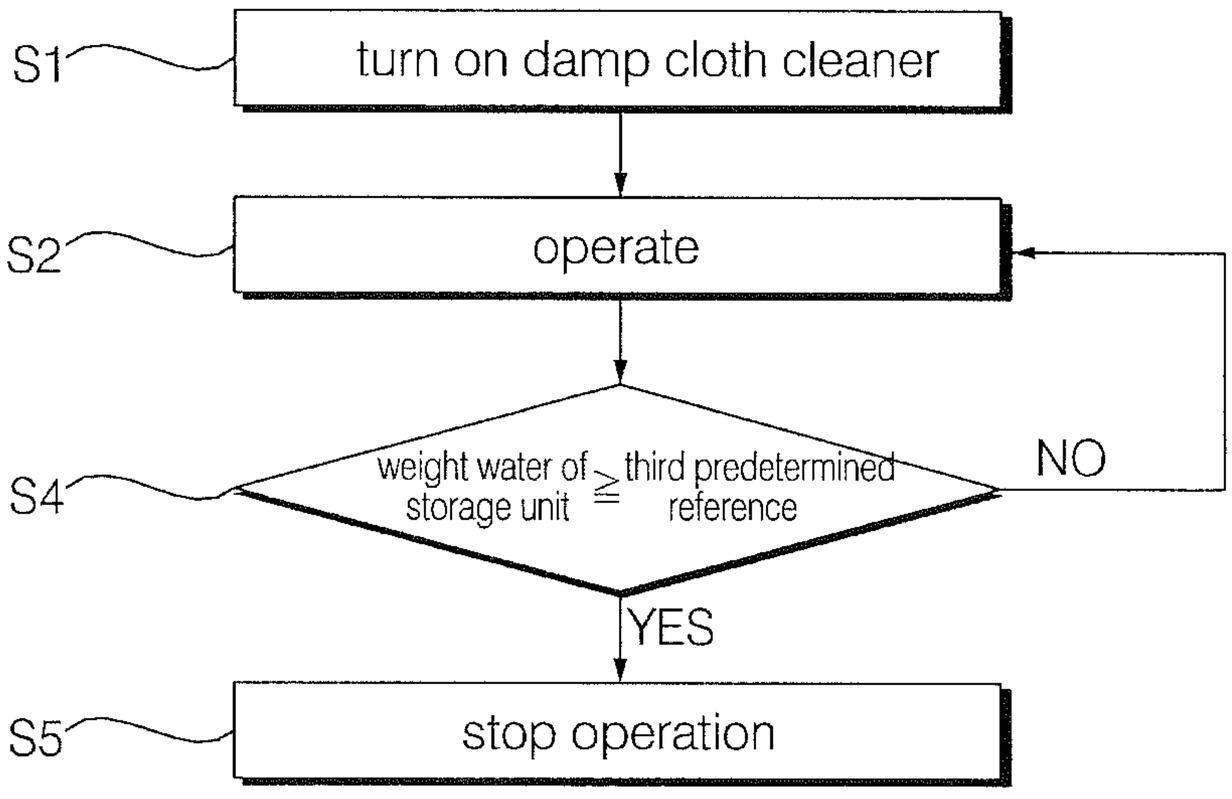
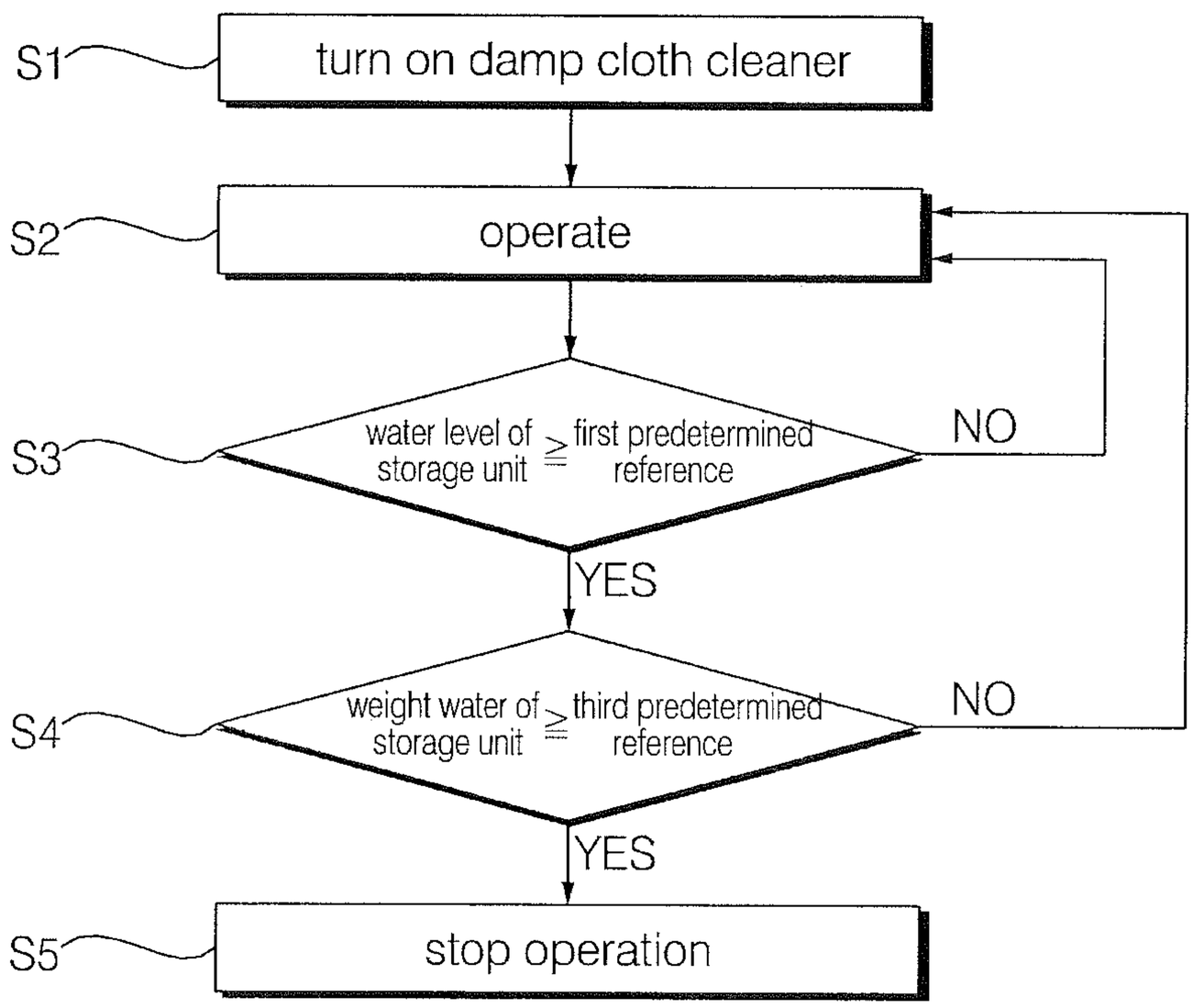

S1
turn on damp cloth cleaner
S2
operate
S4
weight water of storage unit ≥ third predetermined reference
NO
YES
S5
stop operation

FIG. 16


S1
turn on damp cloth cleaner
S2
operate
S3
water level of storage unit ≥ first predetermined reference
NO
YES
S4
weight water of storage unit ≥ third predetermined reference
NO
YES
S5
stop operation

CLEANER AND CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Korean Patent Application No. 10-2015-0114059 filed on Aug. 12, 2015 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

1. Field

The present disclosure relates to a cleaner having both damp cloth and vacuum cleaning functions and a control method thereof, and particularly, to a cleaner having a circulation system of collecting water used in damp cloth, filtering the same, and supplying the filtered water to the cloth, and a control method thereof.

2. Discussion of the Related Art

In a vacuum cleaner, a fan based on a vacuum motor is installed in a main body to suck dust, filth, or rubbish present on a floor of an indoor area. Also, a related art cleaner includes a system for automatically supplying water to damp cloth and collecting water therefrom, and the dump cloth is automatically moved to clean the floor.

The related art cleaner includes a water supply unit supplying water to a dump cloth, a driving unit moving the dump cloth, and a collecting unit collecting water used in the dump cloth. In particular, when the driving unit rotates the dump cloth, the water supply unit supplies water to the center of the damp cloth to allow water to be spread to the entire damp cloth by centrifugal force and causes water used in the damp cloth to be introduced to the collecting unit by centrifugal force.

The related art cleaner includes a water supply tank storing water to be supplied through the water supply unit and a waste water tank storing contaminated water collected through the collecting unit.

SUMMARY

Provided are a cleaner having a circulation system of collecting water used in damp cloth, filtering the same, and supplying the filtered water to the cloth, and a control method thereof. The cleaner includes a storage unit storing water, a collecting unit intaking water used in a cloth and introducing intaken water to an upper side of the storage unit, a filter unit filtering water collected by the collecting unit, a water supply unit allowing water within the storage unit to flow out from a lower portion of the storage unit so as to be supplied to the cloth, a vacuum motor operated to cause water to be intaken to the storage unit through the collecting unit, and a pump operate to allow water to be transferred through the water supply unit.

According to an innovative aspect of the subject matter described in this application, a cleaner includes a rotary plate; a cloth that is attached to a bottom of the rotary plate and that is configured to receive water; a rotation driving unit that is connected to an upper portion of the rotary plate and that is configured to rotate the rotary plate about an axis that is perpendicular to the rotary plate; a storage unit that is configured to store water, a collecting unit that is configured to collect water from the cloth and that is configured to provide water to an upper side of the storage unit; a filter unit that is configured to filter water that is collected by the collecting unit; a water supply unit that is configured to receive water from a lower portion of the storage unit and that is configured to provide water to the cloth; a vacuum motor that is configured to move water from the storage unit through the collecting unit; and a pump that is configured to move water through the water supply unit.

The cleaner may include one or more of the following features. The water supply unit includes a main pipe that is connected to the storage unit and that is configured to guide water from the storage unit to a center of the rotary plate; and a dispersion pipe that is connected to the main pipe, that is parallel to the rotary plate, that is configured to disperse water received from the main pipe along concentric circles that share a common center at the center of the rotary plate, and that defines a plurality of dispersion holes. The rotary plate defines a plurality of supply holes that are configured to supply water to the cloth. The dispersion pipe is located inside the rotary plate. The rotary plate defines a space that is configured to allow rotation of the dispersion pipe and includes a rotational shaft that is perpendicular to the rotary plate, that is located on an upper portion of the rotary plate, that defines a through hole, and that is configured to receive the main pipe. The plurality of supply holes are located in a lower portion of the rotary plate and are configured to communicate with the space. The water supply unit include additional dispersion pipes that are each connected to the main pipe, that are each rotationally symmetrical to the dispersion pipe, and that each define a same angle between adjacent dispersion pipes.

The plurality of supply holes are located along lines that radiate from the center of the rotary plate. A density of the plurality of supply holes decreases as a distance from the center of the rotary plate increases. The collecting unit includes an outer partition that is located around a circumference of the rotary plate; an inner partition that is located between the circumference of the rotary plate and the outer portion; an intake that is located at the outer partition and that is configured to draw water into a gap that is located between the outer portion and the inner portion; and a collecting pipe that is configured to guide water that is received through the intake to the to the storage unit. The filter unit is located within the storage unit and between the collecting unit and the water supply unit. The storage unit is configured to provide access to the filter unit through an openable structure. The filter unit is located within the storage unit and between the collecting unit and the water supply unit, and is removable from the storage unit. The filter unit is located within the storage unit and between the collecting unit and the water supply unit, and includes a filter net that is configured to collect foreign objects in water and a filter frame that is configured to support the filter net.

The filter net is concave with respect to a top of the filter unit. The filter unit includes a filter net that is configured to collect foreign objects in water and a filter frame that is configured to support the filter net. The storage unit further includes a guide rail that is configured to support the filter frame is located on an inner surface of the storage unit. The filter unit is removable from the storage unit. The guide rail is configured to guide and support the filter frame. The cleaner includes a first water level sensor that is configured to sense a water level within the storage unit and that is configured to transmit a first signal based on the water level being equal to or higher than a first predetermined reference; and a controller that is configured to control the vacuum motor and the pump and that is configured to stop the vacuum motor and the pump in response to receiving the first signal. The first predetermined reference is a water level that is lower than a connection point of the storage unit and the collecting unit. The cleaner includes a second water level sensor that is configured to sense a water level within the

storage unit, and that is configured to transmit a second signal based on the water level being lower than a second predetermined reference; a notification unit that is configured to output information from the cleaner, and a controller that is configured to control the notification unit to output water shortage information in response to receiving the second signal.

The cleaner includes a weight sensor that is configured to sense a weight of water within the storage unit and that is configured to transmit a third signal based on the weight being equal to or greater than a third predetermined reference; and a controller that is configured to control the vacuum motor and the pump and that is configured to stop the vacuum motor and the pump in response to receiving the third signal. The cleaner includes a weight sensor that is configured to sense a weight of water within the storage unit, and that is configured to transmit a fourth signal based on the weight being lower than a fourth predetermined reference; a notification unit that is configured to output information from the cleaner; and a controller that is configured to control the notification unit to output water shortage information in response to receiving the fourth signal. The vacuum motor is located on an upper portion of the storage unit. The storage unit includes an intake hole that is configured to communicate with the vacuum motor, a first partition that covers the intake hole and that extends from an inside side wall of the storage unit toward an inside upper wall of the storage unit, and a second partition that covers the first partition, that extends from the inside upper wall toward the inside side wall of the storage unit, and that defines a gap with the inside side wall.

According to another innovative aspect of the subject matter described in this application, a method for controlling a cleaner that includes a cloth, a storage unit that is configured to store water, a water supply unit that is configured to supply water from the storage unit to the cloth, and a collecting unit that is configured to collect water from the cloth and provide water to the storage unit, includes the actions of activating the cleaner, sensing a water level within the storage unit; determining whether the sensed water level is equal to or higher than a first predetermined reference; and based on the sensed water level being equal to or higher than the first predetermined reference, deactivating the cleaner, and based on the sensed water level being lower than the first predetermined reference, continuing to operate the cleaner.

According to another innovative aspect of the subject matter described in this application, a method for controlling a cleaner that includes a cloth, a storage unit that is configured to store water, a water supply unit that is configured to supply water from the storage unit to the cloth, and a collecting unit that is configured to collect water from the cloth and provide water to the storage unit, includes the actions of activating the cleaner; sensing a weight of water within the storage unit; determining whether the sensed weight is equal to or greater than a third predetermined reference; and based on the sensed weight being equal to or greater than the third predetermined reference, deactivating the cleaner, and based on the sensed weight being lower than the third predetermined reference, continuing to operate the cleaner.

According to another innovative aspect of the subject matter described in this application, a method for controlling a cleaner that includes a cloth, a storage unit that is configured to store water, a water supply unit that is configured to supply water from the storage unit to the cloth, and a collecting unit that is configured to collect water from the cloth and provide water to the storage unit, includes the actions of activating the cleaner, sensing a water level within the storage unit; determining whether the sensed water level is equal to or higher than a first predetermined reference; sensing a weight of water within the storage unit; determining whether the sensed weight is equal to or greater than a third predetermined reference; and based on the sensed water level being equal to or higher than the first predetermined reference and based on the sensed weight being equal to or greater than the third predetermined reference, deactivating the cleaner, and based on the sensed water level being lower than the first predetermined reference or based on the sensed weight being lower than the third predetermined reference, continuing to operate the cleaner.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a perspective view illustrating an internal configuration without a casing in a cleaner according to an embodiment.

FIG. **2** is a cross-sectional view of a head part of FIG. **1**, vertically taken along line A-A', in which a rotation driving unit is indicated by the dotted lines.

FIG. **3** is a perspective view illustrating a structure of a dispersion pipe and a rotary plate indicated the dotted line according to a first embodiment.

FIG. **4** is a perspective view illustrating a structure of a dispersion pipe and a rotary plate indicated the dotted line according to a second embodiment.

FIG. **5** is a perspective view illustrating a structure of a dispersion pipe and a rotary plate indicated the dotted line according to a third embodiment.

FIG. **6** is a bottom view of a rotary plate in which a plurality of supply holes are arranged, without cloth, according to a fourth embodiment.

FIG. **7** is a bottom view of a rotary plate in which a plurality of supply holes are arranged, without cloth, according to a fifth embodiment.

FIG. **8** is an enlarged perspective view of the rotation driving unit of FIG. **1**.

FIG. **9** is a perspective view illustrating an internal configuration in which a storage tank of a storage unit of FIG. **1** is transparently shown and a collecting unit, a water supply unit connected to the storage unit, a filter unit, a vacuum motor, a pump, and various sensors are provided.

FIG. **10** is a cross-sectional view of the storage unit of FIG. **9**, vertically taken along line B-B'.

FIG. **11** is a perspective view of a storage unit illustrating a state in which an openable structure of a storage unit according to an embodiment is closed.

FIG. **12** is a perspective view of a storage unit illustrating a state in which the openable structure of FIG. **11** is open.

FIG. **13** is a block diagram of a controller receiving a signal from various sensors and an input unit and controlling various devices.

FIG. **14** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to a sixth embodiment.

FIG. **15** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to a seventh embodiment.

FIG. **16** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to an eighth embodiment.

DETAILED DESCRIPTION

Advantages and features of the present disclosure and implementation methods thereof will be clarified through following exemplary embodiments described with reference to the accompanying drawings. The present disclosure may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present disclosure to those skilled in the art. Further, the present invention is only defined by scopes of claims. Throughout the specification, like numbers refer to like elements.

A cleaner according to an embodiment may be utilized to perform damp cloth cleaning and vacuum suction cleaning on a floor, a wall, or a window and may be a portable small device or a large device. In the disclosure, "cloth" may have a meaning including various materials and structures that can be employed by a person skilled in the art, such as brush or a rag. The cloth may be fixedly coupled to the cleaner or may be detachably coupled to the cleaner.

Hereinafter, an embodiment of a cleaner which is portable and has cloth using water attached thereto will be mainly described. FIG. **1** is a perspective view illustrating an internal configuration of a cleaner in which a casing **1** is indicated by the dotted line according to an embodiment.

Hereinafter, words such as 'first, second, third, and forth' written in front of components such as 'partition, signal, and predetermined reference' are used to distinguish the components regardless of a priority.

Referring to FIG. **1**, the cleaner includes the casing **1** forming an appearance, a cloth **9** wetted with water so as to be used, and a rotary plate **10** allowing the cloth **9** to be fixed to a lower side thereof. The cloth **9** is attached to a bottom of the rotary plate **10** and is configured to receive water. The rotary plate **10** is installed to be rotatable in a horizontal direction. That is, the rotary plate **10** is installed to be rotatable in a direction parallel to a lower surface thereof to which the cloth **9** is fixed.

The casing **1** forms an appearance of the device and provides a space for accommodating various components therein. The rotary plate **10** and the cloth **9** are disposed in a front portion of the casing **1**, and here, the portion is defined as a head part **3**. The cloth **9** is fixed to the head part **3** such that a cloth surface is dispose to face downwardly.

The cleaner includes a rotation driving unit **20** installed on an upper side of the rotary plate **10** and rotating the rotary plate **10**. The rotation driving unit **20** is connected to an upper portion of the rotary plate **10**. The rotation driving unit **20** is configured to rotate the rotary plate **10** about an axis that is perpendicular to the rotary plate **10**. The cleaner includes a storage unit **30** storing water to be used in the cloth **9** and to be re-supplied to the cloth **9**, a collecting unit **40** intaking water used in the cloth **9** from a circumference of the rotary plate **10** and introducing the intaken water to an upper side of the storage unit **30**, and a water supply unit **50** causing water within the storage unit **30** to flow out from a lower portion of the storage unit **30** so as to be supplied to the cloth **9**.

The storage unit **30** is configured to store water. The collecting unit **40** is configured to collect water from the cloth **9** and to provide water to an upper side of the storage unit **30**. The water supply unit **50** is configured to receive water from a lower portion of the storage unit **30** and to provide water to the cloth **9**.

The cleaner includes a filter unit **60** filtering water collected by the collecting unit **40**. The filter unit **60** is configured to filter water that is collected by the collecting unit **40**. The filter unit **60** may be disposed in the collecting unit **40**, but in the present disclosure, the filter unit **60** is disposed within the storage unit **30**. Filtering performed by the filtering unit **60** may include a chemical purification scheme or a physical filtering scheme based on a filter net. In this embodiment, the physical filtering scheme will be largely described.

The cleaner includes a vacuum motor **70** installed on an upper portion of the storage unit **30** and operating to allow water to be intaken to the storage unit **30** through the collecting unit **40** and a pump **80** installed on a lower portion of the storage unit **30** and operating to allow water to be transferred through the water supply unit **50**. The vacuum motor **70** is located on an upper portion of the storage unit **30**. The vacuum motor **70** is configured to move water from the storage unit **30** through the collecting unit **40**. The pump **80** is configured to move water through the water supply unit **50**.

The cleaner includes a battery **5** supplying electric power to the rotation driving unit **20**, the vacuum motor **70**, and the pump **80** through a power connection line **6**. The cleaner includes a power switch (not shown) allowing a user to turn on or off power and an input unit (not shown) for inputting various manual operations. The cleaner includes a notification unit that includes a speaker for outputting sound or a display for outputting visual information in order to inform the user about an operational state and a malfunction/error state of the device. The cleaner may include a controller **7** controlling operations of various driving devices **21**, **70**, and **80** and a degree of operations of the driving devices **21**, **70**, and **80** and controlling output of the notification unit, upon receiving signals from various sensors **91**, **92**, and **95**, and the input unit.

FIG. **2** is a cross-sectional view of the head part **3** of FIG. **1** without the rotation driving unit **20**, vertically taken along line A-A'. Referring to FIG. **2**, the head part **3** forms a space depressed upwardly from a lower surface thereof overall, and the rotary plate **10** and the cloth **9** fixed to the rotary plate **10** are disposed in the depressed space. The cloth **9** is disposed in a lower portion of the head part such that a lower surface thereof contacts the floor when the depressed space of the head part **3** faces in a floor direction and edges of the head part contact the floor.

The water supply unit **50** includes a main pipe **51** connected to the storage unit **30** in one end thereof and guiding water from the storage unit **30** to the center of the rotary plate **10**. The main pipe that **51** is connected to the storage unit. The main pipe that **51** is configured to guide water from the storage unit **30** to a center of the rotary plate **10**. The pump **80** is disposed on the main pipe **51**. When one end of the main pipe **51** is connected to the storage unit **30**, it may mean that the pump **80** is directly connected to the storage unit **30** and the main pipe **51** is connected to the pump **80**. The main pipe **51** may be formed of various materials, and here, the main pipe **51** may be formed of a rigid metal or a synthetic resin material in order not to interfere with a rotational movement of the rotary plate **10**.

The water supply unit **50** includes a dispersion pipe **53** connected to the other end of the main pipe **51** and forming continuous piping. The dispersion pipe **53** extends in a

diameter direction of the rotary plate **10**. The dispersion pipe **53** disperses water guided by the main pipe **51** in the diameter direction of the rotary plate **10**. The dispersion pipe **53** may extend within the rotary plate **10**. The dispersion pipe **53** may extend in a diameter direction within the rotary plate **10** and disperse water guided from the main pipe **51** in the diameter direction of the rotary plate **10**. The other end of the dispersion pipe **53** is closed. The dispersion pipe **53** is supported by a connection point with the main pipe **51**. The dispersion pipe **53** is formed of a material such as a rigid metal or a synthetic resin material allowing a form to be fixed.

The dispersion pipe **53** is connected to the main pipe **51**. The dispersion pipe **53** is parallel to the rotary plate **10**. The dispersion pipe **53** is configured to disperse water received from the main pipe **51** along concentric circles that share a common center at the center of the rotary plate **10**. The dispersion pipe **53** is located inside the rotary plate **10**. The water supply unit **50** includes a plurality of dispersing holes **55** formed along the dispersion pipe **53**. The dispersion pipe **53** defines the plurality of dispersion holes **53**. The dispersion holes **55** may be formed on a side surface or an upper surface of the dispersion pipe **53**. In this embodiment, the dispersion holes **55** are provided on a lower surface of the dispersion pipe **53** to allow water from the dispersion pipe **53** to flow downwardly. The plurality of dispersion holes **55** may be formed to be spaced apart from each other at a predetermined interval.

A space **12** may be provided along a relative movement trace of the dispersion pipe **533** according to a rotational movement of the rotary plate **10** within the rotary plate **10**. Also, a rotational shaft **15** having a through hole **16** communicating with the space **12** in an axial direction to allow the main pipe **51** to be drawn to a central inner side thereof may be provided in an upper portion of the rotary plate **10**. A plurality of supply holes **18** are provided in a penetrating manner vertically to supply water to the cloth **9** in the rotary plate **10**. The plurality of supply holes formed in a lower portion of the rotary plate **10** and communicate with the space **12** such that water may be supplied to the cloth **9**. The plurality of supply holes **18** are provided in a lower portion of the rotary plate **10** and communicate with the space **12**. The plurality of supply holes **18** are located in a lower portion of the rotary plate **10** and are configured to communicate with the space **12**.

The rotary plate **10** defines the plurality of supply holes **18** that are configured to supply water to the cloth **9**. The rotary plate **10** defines the space **12** that is configured to allow rotation of the dispersion pipe **53**. The rotary plate **10** includes the rotational shaft **15** that is perpendicular to the rotary plate **10**, that is located on an upper portion of the rotary plate **10**, that defines the through hole **16**, and that is configured to receive the main pipe **51**.

The rotary plate **10** includes a rotary plate main body **11** having a cylindrical shape overall and the tubular rotational shaft **15** disposed on an upper side of the rotary plate main body **11**. An upper corner of the rotary plate main body **11** has a chamfered shape. On the inner side of the rotary plate main body **11**, the cylindrical space **12** having a height and a diameter lower than those of the external cylindrical shape of the rotary plate main body **11** is provided.

The space **12** may accommodate the dispersion pipe **53**, and the dispersion pipe **53** is disposed to be spaced apart from the space **12**. When the rotary plate main body **11** rotates centered on the rotational shaft **15**, the space **12** is also rotated together. The dispersion pipe **53** is an element separated from the rotary plate **10**, and thus, when the rotary plate main body **11** is rotates, the dispersion pipe **53** stays fixedly in a position. Thus, the dispersion pipe **53** within the space **12** draws a relative rotational movement trace with respect to the space **12** and an inner surface of the space **12** is spaced apart from the relative rotational movement trace of the dispersion pipe **53**. Accordingly, with the dispersion pipe **53** fixed, water may be dispersed to the entirety of the rotary plate and the rotary plate **10** that makes a rotational movement and the fixed dispersion pipe **53** may not interfere with each other.

The rotational shaft **15** having the through hole **16** in an axial direction is provided on an upper surface of the rotary plate main body **11**. The rotational shaft **15** may be formed at the center of the upper surface of the rotary plate main body **11**. The through hole **16** is formed such that the exterior and the space **12** communicate with each other in an axial direction of the rotary shaft. The main pipe **51** is drawn to the center of the space **12** through the through hole **16** from the outside. The other end of the main pipe **51** is positioned at the center of the space **12**. The dispersion pipe **53** is connected to the other end of the remote flow plate **51**. Accordingly, the rotary plate **10** and the rotational shaft **15** make a rotational movement, and even when the main pipe **51** stays in a fixed state, the rotational shaft **15** and the main pipe **51** are disposed not to interfere with each other.

Although not shown in FIG. **2**, in another embodiment, a gasket (not shown) may be provided between an inner surface of the through hole **16** and an outer surface of the main pipe **51** passing through the through hole **16** in order to prevent water within the space **12** from being released to the through hole **16** when the device is reversed. Since the main pipe **51** is fixed even when the rotary plate **10** rotates, the gasket may include a slidable side such that the outer surface of the main pipe **51** and the inner surface of the through hole **16** do not restrain from each other. Accordingly, even when the rotational shaft **15** rotates, the main pipe **51** may be fixed and outflow of water from the interior of the space **12** through the through hole **16** may be prevented.

In FIG. **2**, the arrows C indicates a flow direction of supplied water. When the pump **80** operates, water moves to the center of the space of the rotary plate main body **11** through the main pipe **51**. Such water moves in a diameter direction of the rotary plate **10** through the dispersion pipe **53** connected to the main pipe **51**. Water moving along the dispersion pipe **53** flows out through the plurality of dispersion holes **55** so as to be positioned between the dispersion pipe **53** and the inner surface of the space **12**. Water moves to a lower side of the space **12** according to gravitation. The water moves to the cloth **9** fixed to the lower surface of the rotary plate main body **11** through the plurality of supply holes **18**. Accordingly, clean water may be supplied to the entire area of the cloth **9**.

The collecting unit **40** includes an outer partition **43** disposed along a circumference of the rotary plate **10** and an inner partition **44** disposed to form a gap **45** allowing water to be intaken to an inner side along the outer partition **43**. The outer partition **43** is located around a circumference of the rotary plate **10**. The inner partition **44** is located between the circumference of the rotary plate **10** and the outer portion **43**. The collecting unit **40** includes an intake **48** formed in the outer partition **43** to allow water to be intaken and a collecting pipe **41** guiding water intaken through the intake **48** to the storage unit **30**. The intake **48** is located at the outer partition **43** and is configured to draw water into a gap that is located between the outer portion **43** and the inner portion **41**. The collecting pipe **41** is connected to the storage unit **30**

on one end thereof and connected to the intake **48** on the other end thereof. The collecting pipe **41** is configured to guide water that is received through the intake **48** to the to the storage unit **30**.

The outer partition **43** may have a rounded hemispherical shape along the depressed space of the head part **3**, may have an angular funnel shape, or may have a truncated conic shape or a cylindrical shape. A lower end of the outer partition **43** contacts the floor together with the cloth **9** when cleaning is performed.

The inner partition **44** is disposed to form a gap **45** between the partition along the outer partition **43**. One surface of the inner partition **44** forms a side sectioning the depressed space of the head part **3**, and the opposite surface of the one surface faces the outer partition **43**. The opposite surface of the inner partition **44** and the inner surface of the outer partition **43** are spaced from each other in a facing manner to form a gap **45** between the partitions. The inner partition **44** may have a rounded hemispherical shape along the depressed space of the head part **3**, may have an angular funnel shape, or may have a truncated conic shape or a cylindrical shape, according to the shape of the outer partition **43**.

A lower end of the inner partition **44** is disposed in a position higher than the lower end of the outer partition **43**. Due to the difference in height between the lower end of the inner partition **44** and the lower end of the outer partition **433**, when the outer partition **43** contacts the floor, an intake gap **46** is formed between the floor and the lower end of the inner partition **44**.

At least one intake **48** is formed above the outer partition **43**. The gap **45** between the partitions and the collecting pipe **41** and the collecting pipe **41** communicate with each other through the intake **48**. The rotational shaft **15** of the rotary plate **10** penetrate through a central portion of the outer partition **43** and the inner partition **44** in a vertical direction. In order to prevent the gap **45** between the partitions from communicating with the portion penetrated by the rotational shaft **15**, a connection partition **47** connecting the outer partition **43** and the inner partition **44** in a vertical direction along a circumference of the rotational shaft **15** is provided in the gap **45** between the partitions. The connection partition **47** has a circular tubular shape and has a lower end coupled to the inner partition **43** and an upper end coupled to the outer partition **43**. A length of an inner diameter of the connection partition **47** is equal to or slightly greater than a length of an outer diameter of the rotational shaft **15**. The intake **48** is provided in a position deviating from a central portion of the outer partition **43** so as not to overlap the position of the rotational shaft **15**.

In FIG. **2**, the arrows D indicates a flow direction of collected water. When the rotation driving unit **20** operates, water moves to the cloth **9** or toward the edge of the cloth **9** through the bottom surface according to centrifugal force based on the rotational movement of the rotary plate **10** and the cloth **9**. Also, the water moves to the gap **45** between the partitions through the intake gap **46**. Also, the water moves to the intake **48** along the gap **45** between the partitions. Also, the water is introduced to the collecting pipe **41** through the intake **48** and moves to the storage unit **30** along the collecting pipe **41**. Accordingly, contaminated water may be intaken through the entire circumference of the cloth **9**.

Hereinafter, embodiments according to a structure of the dispersion pipe **53** will be described with reference to FIGS. **3** to **5**. FIG. **3** is a perspective view illustrating a structure of a dispersion pipe **153** according to a first embodiment, FIG. **4** is a perspective view illustrating a structure of a dispersion pipe **253** according to a second embodiment, and FIG. **5** is a perspective view illustrating a structure of a dispersion pipe **353** according to a third embodiment.

In the first embodiment, one dispersion pipe **153** is provided. The dispersion pipe **153** extends in any one of diameter directions of the rotary plate **10**, from the other end of the main pipe **51**. A plurality of dispersion holes **55** are formed along the dispersion pipe **153**. Since the rotary plate **10** makes a rotational movement, water may be dispersed and supplied to the entire bottom surface of the space **12** within the rotary plate even by the single dispersion pipe **153**.

The dispersion pipe **153** may be branched from the main pipe **51** such that a plurality of dispersion pipes form the same angle E of inclination therebetween. In the second embodiment, two dispersion pipes **253** are branched from the main pipe **51** and form an angle of inclination E of 180 degrees therebetween. In the third embodiment, four dispersion pipes **353** are branched from the main pipe **51** and form an angle E of inclination of 90 degrees therebetween. In another embodiment, a plurality of dispersion plates **53** may be branched from the main pipe **51** and form angles of inclination not equal to each other. The water supply unit **50** include additional dispersion pipes **253** that are each connected to the main pipe **51**, that are each rotationally symmetrical to the dispersion pipe **253**, and that each define a same angle between adjacent dispersion pipes **253**.

In the second embodiment, two dispersion pipe **253** are provided. The two dispersion pipes **253** are branched from the other end of the main pipe **51** in the mutually opposite directions. A plurality of dispersion holes **55** are formed along the two dispersion pipes **253**. Compared with the first embodiment in which was is supplied to a portion of the bottom surface of the rotary plate **10** once while the rotary plate **10** rotates once, in the second embodiment, water is supplied to a portion of the bottom surface of the rotary plate **10** twice while the rotary plate **10** rotates once. That is, in the second embodiment, the same amount of water may be supplied to the cloth **9** in a divided manner twice while the rotary plate **10** rotates once.

In the third embodiment, four dispersion pipes **353** are provided. The four dispersion pipes **253** are branched from the other end of the main pipe **51** in the mutually opposite directions by twos. A plurality of dispersion holes **55** are formed along the four dispersion pipes **353**. Compared with the first embodiment in which was is supplied to a portion of the bottom surface of the rotary plate **10** once while the rotary plate **10** rotates once, in the third embodiment, water is supplied to a portion of the bottom surface of the rotary plate **10** four times while the rotary plate **10** rotates once. That is, in the third embodiment, the same amount of water may be supplied to the cloth **9** in a divided manner four times while the rotary plate **10** rotates once.

Even in a case in which the numbers of dispersion pipes **53** are different in an application example of the second embodiment and the third embodiment, a person in the art may sufficiently anticipate a configuration and effect thereof, and thus, descriptions of other embodiment will be omitted.

The plurality of supply holes **18** are formed on a lower surface of the rotary plate **10**. The plurality of supply holes **18** may be evenly arranged on the entire area of the lower surface of the rotary plate or may be arranged with high density in a partial area of the lower surface of the rotary plate **10**. The plurality of supply holes **18** may be arranged in a diameter direction of the lower surface of the rotary plate **10**. The plurality of supply holes **18** may be arranged to traverse a center of the lower surface of the rotary plate

10. The plurality of supply holes **18** are located along lines that radiate from the center of the rotary plate **10**.

Hereinafter, two among various embodiments of arrangement of a plurality of supply holes **18** will be described. FIG. **6** is a bottom view of the rotary plate **10** in which a plurality of supply holes **418** are arranged according to a fourth embodiment, and FIG. **7** is a bottom view of the rotary plate **10** in which a plurality of supply holes **518** are arranged according to a fifth embodiment.

In the fourth embodiment, the plurality of supply holes **418** are arranged to be parallel to each other in two rows on a lower surface of the rotary plate **10**. A plurality of arrangement groups of the plurality of holes **418** arranged in the two rows may be formed. In this embodiment, four arrangement groups are provided and formed at the same angle of inclination of 45 degrees Accordingly, portions to which water is concentratedly supplied are disposed to be spaced apart from each other at a predetermined interval in a circumferential direction on the lower surface of the rotary plate **10**.

In the fifth embodiment, the plurality of supply holes **518** are arranged such that the number of density thereof is decreased in a direction toward an outer side from the center of the lower surface of the rotary plate **10**. The density of the plurality of supply holes **518** decreases as a distance from the center of the rotary plate **10** increases. In this embodiment, the plurality of supply holes **518** are formed in a diameter direction of the rotary plate **10**, and here, intervals between the plurality of supply holes **518** are gradually decreased in a direction toward the center of the rotary plate **10** and gradually increased in an outward direction of the rotary plate **10**. Accordingly, clean water may be supplied to the entire area of the cloth **9** and a larger amount of water may be supplied to the center of the cloth **9**. Since water supplied to the center of the cloth **9** may be moved toward a marginal portion (or an edge portion) of the cloth **9** by centrifugal force based on a rotational movement of the rotary plate **10**, a less amount of clean water is additionally distributed to be supplied to the marginal portion of the cloth **9**, than that supplied to the central portion of the cloth **9** in this embodiment.

FIG. **8** is an enlarged perspective view of the rotation driving unit **20** of FIG. **1**. The rotation driving unit **20** includes a rotary motor **21** in which a motor rotational shaft is formed to be horizontal, a worm **23** formed along the motor rotational shaft, and a worm wheel **25** having a disk shape in the vicinity of the rotational shaft **15** and vertically engaged with the worm **23**. Accordingly, the motor rotational shaft (not shown) and the rotational shaft **15** cross vertically to transmit power from the rotary motor **21** to the rotational shaft **15**.

Referring to FIG. **9**, the filter unit **60** is horizontally disposed within the storage unit **30**. FIG. **9** is a perspective view illustrating an internal configuration in which the storage tank **31** of the storage unit **30** of FIG. **1** is transparently shown. The filter unit **60** is located within the storage unit **30** and between the collecting unit **40** and the water supply unit **50**. The filter unit **60** is disposed between a connection point of the collecting unit **40** and a connection point of the water supply unit **50** within the storage unit **30**. The connection point of the collecting unit **40** means a connection point between the collecting unit **40** and the storage unit **30**. The connection point of the water supply unit **50** means a connection point between the water supply unit **50** and the storage unit **30**. That is, the filter unit **60** is disposed on a side lower than the point where the storage unit **30** and the collecting pipe **41** are connected so that water introduced to the interior of the storage unit **30** through the collecting pipe **41** passes through the filter unit **60** by gravitation. Also, the filter unit **60** is disposed on a side higher than the point where the storage unit **30** and the main pipe **51** are connected so that water which has passed through the filter unit **60** is accommodated on a lower side of the storage unit **30** or flows out through the main pipe **51**.

The filter unit **60** includes a filter net **61** collecting a foreign object included in collected water and a filter frame **63** supporting the filter net **61**. The filter net **61** is configured to collect foreign objects in water. The filter frame **63** is configured to support the filter net **61**. Also, the filter unit **60** may include a known chemical or physical unit for removing a contaminant included in collected water.

The filter net **61** includes a portion horizontally traversing the storage unit **30**. The filter net **61** may have a shape in which a surface thereof is depressed in a downward direction. The filter net **61** is concave with respect to a top of the filter unit **60**. Accordingly, a collected foreign object may easily gather in the depressed filter net **61** portion. The filter net **61** may be disposed to have a hexahedral shape without an upper surface. Thus, a foreign object may be easily gather in the lower surface portion of the filter net **61**.

The filter frame **63** fixedly support an outer side of the filter net **61** disposed in various shapes. The filter frame **63** is supported by an inner wall of the storage unit **30**. The filter frame **63** may have a structure connected to be detachably attached to the inner wall of the storage unit **30**.

Referring to FIGS. **11** and **12**, the storage unit **30** may have a structure **35** that can be opened such that the filter unit **60** is exposed outwardly. FIG. **11** is a perspective view of the storage unit **30** illustrating a state in which the openable structure **35** of the storage unit **30** according to an embodiment is closed, and FIG. **12** is a perspective view of the storage unit **30** illustrating a state in which the openable structure **35** of FIG. **11** is open. The storage unit **30** is configured to provide access to the filter unit **60** through the openable structure.

The openable structure **35** may be a hinged structure or a sliding structure. The openable structure **35** may include a hinge **36** allowing a partial external surface of the storage unit **30** is rotated to be opened. The storage unit **30** is configured to provide access to the filter unit **60** through a hinged access panel. The openable structure **35** may include a gasket (not shown) preventing generation of a gap through which water may be leaked in a closed state. The openable structure **35** may include a separation pin **37** for fixing the openable structure **35** such that the openable structure **35** is not opened in a closed state. The openable structure **35** may be opened when a user separates the separation pin **37** from the storage unit **30**.

Referring to FIG. **10**, the filter unit **60** may be drawn out and drawn in from the outside of the storage unit **30**. the filter unit **60** may be removable from the storage unit **30**. The filter frame **63** may include a horizontal frame **63***a* which contacts an inner surface of the storage unit **30** and forms a circumference on a horizontal surface. In this embodiment, the horizontal frame **63***a* forms an upper end of the filter frame **63**, but it may also form a lower end of the filter frame **63**. The filter frame **63** may include an auxiliary frame **63***b* horizontally formed on the opposite side of the horizontal frame **63***a* among the upper end and the lower end of the filter frame **63**. In this embodiment, the auxiliary frame **63***b* is formed at the lower end of the filter frame **63**. The auxiliary frame **63***b* is disposed at a circumference of the filter net **61** forming a lower surface of the filter unit **60**. The filter frame **63** includes a connection frame **63***c* vertically

connecting the horizontal frame **63***a* and the auxiliary frame **63***b*. One end of the connection frame **63***c* is coupled to the horizontal frame **63***a*, and the other end thereof is coupled to the auxiliary frame **63***b*. The connection frame **63***c* is supported by the horizontal frame **63***a*, and the auxiliary frame **63***b* is supported by the connection frame **63***c*. The connection frame **63***c* supports the filter net **61** forming a side surface of the filter unit **60**.

A guide rail **30***a* may be formed on an inner surface of the storage unit **30** along the horizontal frame **63***a*. The guide rail **30***a* may protrude from the inner surface of the storage unit **30** or may be depressed from the inner surface of the storage unit **30**. The guide rail **30***a* may support the filter frame **63**. In detail, the guide rail **30***a* may support the horizontal frame **63***a*. The guide rail **30***a* may movably support the filter frame **63**. The guide rail **30***a* may slidably support the filter frame **63**. The guide rail **30***a* is configured to guide and support the filter frame **63**.

The horizontal frame **63***a* may be drawn out in any one direction of the storage unit **30** along the guide rail **30***a*. In the embodiment in which the openable structure **35** is provided, the filter unit **60** may be drawn in or out through an opening formed on one surface of the storage unit **30** in a state in which the openable structure **35** is opened.

FIG. **10** is a cross-sectional view of the storage unit **30** of FIG. **9**, vertically taken along line B-B'. Referring to FIGS. **9** and **10**, the storage unit **30** includes an intake hole **72** formed therein at a point where the storage unit **30** is connected to the vacuum motor **70**. The intake hole **72** is configured to communicate with the vacuum motor **70**.

The storage unit **30** includes a first partition **32** covering the intake hole **72** and extending from an inside side wall of the storage unit **30** toward an inside upper wall of the storage unit **30**. The first partition **32** forms a gap with the inside upper wall and air may move between two spaces divided by the first partition **32** through the gap.

The storage unit **30** includes a second partition **33** covering the first partition **32** and extending from the inside upper wall toward the inside side wall. The second partition **33** forms a gap with the inside side wall and air may move between two spaces divided by the second partition **33** through the gap. The second partition **33** defines a gap with the inside side wall.

An upper end of the first partition **32** is spaced apart from the upper surface of the storage unit **30** to form a gap therebetween. A lower end of the first partition **32** is coupled to one of side surfaces of the storage unit **30** in which the intake hole **72** is formed. A lower end of the first partition **32** is coupled to an inner surface of the storage unit **30** below the intake hole **72**. Both side ends of the first partition **32** are coupled to the inner surface of the storage unit **30**. In another embodiment, both side ends of the first partition **32** may be bent upwardly so as to be coupled to an upper surface of the storage unit **30**.

A lower end of the second partition **33** is spaced apart from one of the side surfaces of the storage unit **30** in which the intake hole **72** is formed to form a gap therebetween, and disposed to be spaced apart from the first partition **32** below the first partition to form a gap therebetween. An upper end of the second partition **33** is coupled to the upper surface of the storage unit **30**. Both side ends of the second partition **33** are coupled to the inner surface of the storage unit **30**. In another embodiment, the both side ends of the second partition **33** may be bent upwardly so as to be coupled to an upper surface of the storage unit **30** or coupled to the first partition **32**.

Even though the device slopes forwardly or backwardly, introduction of water to the intake hole **72** may be prevented through the first partition **32** and the second partition **33**.

Referring to FIG. **13**, the controller **7** receives signals from various sensors **91**, **92**, and **95** and the input unit **4**. The controller **7** controls the notification unit **8**, the rotary motor **21**, the vacuum motor **70**, and the pump **80**.

The cleaner may include water level sensors **91** and **92** sensing a water level within the storage unit **30**. The water level sensors **91** and **92** may be mechanical sensors including a float (not shown) remaining on a water surface, a bar (not shown) connected to the float in one end thereof, and a hinge **36** provided at the other end of the bar and being rotatable in a vertical direction. The water level sensors **91** and **92** may employ various other schemes that may be implemented by a person skilled in the art.

The cleaner may include a weight sensor **95** sensing a weight of water within the storage unit **30**. Sensing a weight of water within the storage unit **30** also includes sensing the sum of a weight of the storage unit **30** having an interior filled with water and a weight of water. A bracket (not shown) may protrude from an inner side of the casing **1** or from a separate support member (not shown) connected to the casing **1** and support the storage unit **30**. A weight sensor **95** may be provided to sense a weight when a connection portion of the bracket and the storage unit **30** is deformed. The weight sensor **95** may employ various other schemes that may be implemented by a person skilled in the art.

The cleaner may include a first water level sensor **91** transmitting a first signal when a water level is equal to or higher than a first predetermined reference and the controller **7** controlling the vacuum motor **70** and the pump **80** to be stopped from operation, upon receiving the first signal. In this case, the first predetermined reference may be a water level that is lower than a connection point of the storage unit **30** and the collecting unit **40**. Accordingly, in a case in which water excessively rises within the storage unit **30** to flow backwards to the collecting pipe **41** to cause a possibility of malfunction, an operation of the device is stopped to prevent malfunction.

The first water level sensor **91** is configured to sense a water level within the storage unit **30**. The first water level sensor **91** is configured to transmit the first signal based on the water level being equal to or higher than the first predetermined reference. The controller **7** is configured to control the vacuum motor **70** and the pump **80** and is configured to stop the vacuum motor **70** and the pump **80** in response to receiving the first signal.

The cleaner may include a second water level sensor **92** transmitting a second signal when a water level is lower than a second predetermined reference and the controller **7** controlling the notification unit **8** to output water quantity shortage information, upon receiving the second signal. In this case, the second predetermined reference may be a water level lower than the first predetermined reference. The second predetermined reference is a water level lower than a point where the filter unit **60** is disposed. The second predetermined reference is a water level higher than a point where the main pipe **51** is connected to a lower portion of the storage unit **30**, and when a water level is lowered than the second predetermined reference, water may not be normally supplied. Thus, when a quantity of water within the storage unit **30** is so small that the device cannot be normally operated, the user may be easily informed thereabout.

The second water level sensor **92** is configured to sense a water level within the storage unit **30**. The second water level sensor **92** is configured to transmit the second signal

based on the water level being lower than the second predetermined reference. The notification unit **8** that is configured to output information from the cleaner. The controller **7** is configured to control the notification unit **8** to output water shortage information in response to receiving the second signal.

The cleaner may include the weight sensor **95** transmitting a third signal when the weight is equal to or grater than a third predetermined reference, and the controller **7** controlling the vacuum motor **70** and the pump **80** to be stopped from operation, upon receiving the third signal. In this case, the third predetermined reference may be a weight when water within the storage unit **30** rises to a water level at which water does not flow backwards to the collecting pipe **41** in a state in which the storage unit **30** is horizontally placed. Accordingly, in a case in which water excessively rises within the storage unit **30** to flow backwards to the collecting pipe **41** to cause a possibility of malfunction, the operation of the device is stopped to prevent malfunction.

The weight sensor **95** is configured to sense a weight of water within the storage unit **30**. The weight sensor **95** is configured to transmit the third signal based on the weight being equal to or greater than the third predetermined reference. The controller **7** is configured to control the vacuum motor **70** and the pump **80**. The controller **7** is configured to stop the vacuum motor **70** and the pump **80** in response to receiving the third signal.

The cleaner may include the weight sensor **95** transmitting a fourth signal when the weight is lower than a fourth predetermined reference and the controller **7** controlling the notification unit **8** to output water quantity shortage information, upon receiving the fourth signal. In this case, the fourth predetermined level is a weight lower than the third predetermined reference. The fourth predetermined reference is a weight when water within the storage unit **30** rises to a water level lower than the point where the filter unit **60** is disposed in a state in which the storage unit **30** is horizontally placed. The fourth predetermined reference is a weight when water within the storage unit **30** rises to a water level higher than the point where the main pipe **51** is connected to a lower portion of the storage unit **30** in a state in which the storage unit **30** is horizontally placed. When a quantity of water is reduced to be lower than the fourth predetermined reference, water may not be normally supplied. Thus, when a quantity of water within the storage unit **30** is so small than the device cannot be normally operated, the user may be easily informed thereabout.

The weight sensor **95** is configured to sense a weight of water within the storage unit. The weight sensor **95** is configured to transmit the fourth signal based on the weight being lower than the fourth predetermined reference. The notification unit **8** is configured to output information from the cleaner. The controller **7** is configured to control the notification unit **8** to output water shortage information in response to receiving the fourth signal.

The third predetermined reference and the fourth predetermined reference may be set to the weight values in accordance with the water levels described above. The weight sensor **95** may be provided to supplementarily check a water level value sensed by the water level sensors **91** and **92** due to tilting of the device and transmit a corresponding signal to the controller **7**.

FIG. **14** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to a sixth embodiment, FIG. **15** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to a seventh embodiment, and FIG. **16** is a flow chart illustrating an algorithm of a method for controlling a cleaner according to an eighth embodiment.

Referring to FIGS. **14** to **16**, a method for controlling a cleaner according to an embodiment of the present disclosure includes step S**1** in which the cleaner is turned on and operated. That is, the user turns on the cleaner by the power switch (S**1**). The cleaner is activated (S**1**).

The control method includes step S**2** in which the cleaner is operated, after the step S**1** of turning on the cleaner. In the operation step S**2**, strength or speed of the vacuum motor **70**, the pump **80**, and the rotary motor **21** of the cleaner may be adjusted.

The control method may include a water level determining step S**3** in which a water level within the storage unit **30** is sensed and whether the water level is equal to or higher than the first predetermined reference is determined, after the operation step S**2**.

The control method may include a weight determining step S**4** in which a weight of water within the storage unit **30** is sensed and whether the weight is equal to or greater than the third predetermined reference is determined, after the operation step S**2**.

According to embodiments, the control method may include only any one of the water level determining step S**3** and the weight determining step S**4**. The control method may include both the water level determining step S**3** and the weight determining step S**4**, and in this case, the order of the water level determining step S**3** and the weight determining step S**4** may be interchanged. FIG. **16** illustrates a flow chart when the water level determining step S**3** is performed before the weight determining step S**4**.

In the sixth embodiment (please refer to FIG. **14**) in which the control method includes the water level determining step S**3** and does not include the weight determining step S**4**, the control method may include a control step in which the operation of the cleaner is stopped (S**5**) when the water level is equal to or higher than the first predetermined reference and the operation of the cleaner is continuously performed (S**2**) when the water level is lower than the first predetermined reference, after the water level determining step (S**3**). Based on the sensed water level being equal to or higher than the first predetermined reference, the cleaner is deactivated. And, based on the sensed water level being lower than the first predetermined reference, the cleaner is continuously operated.

In the seventh embodiment (please refer to FIG. **15**) in which the control method does not include the water level determining step S**3** and includes the weight determining step S**4**, the control method may include a control step in which the operation of the cleaner is stopped (S**5**) when the water level is equal to or higher than the third predetermined reference and the operation of the cleaner is continuously performed (S**2**) when the water level is lower than the third predetermined reference, after the weight determining step (S**4**). Based on the sensed weight being equal to or greater than the third predetermined reference, the cleaner is deactivated. And, based on the sensed weight being lower than the third predetermined reference, the cleaner is continuously operated.

In the eight embodiment (please refer to FIG. **16**) in which the control method includes both the water level determining step S**3** and the weight determining step S**4**, the control method may include a control step in which the operation of the cleaner is stopped (S**5**) only when the water level is equal to or higher than the first predetermined reference and the weight is equal to or greater than the third predetermined

reference and the operation of the cleaner is continuously performed (S2) when the water level is lower than the first predetermined reference or the weight is less than the third predetermined reference. Based on the sensed water level being equal to or higher than the first predetermined reference and based on the sensed weight being equal to or greater than the third predetermined reference, the cleaner is deactivated. And, Based on the sensed water level being lower than the first predetermined reference or based on the sensed weight being lower than the third predetermined reference, the cleaner is continuously operated.

Specific exemplary embodiments have been described. However, the present disclosure is not limited to the specific exemplary embodiments and various modifications may be made without departing from the scope of the present invention claimed in the claims, and such modifications should not be individually understood from technical concepts or prospects of the present disclosure.

What is claimed is:

1. A cleaner comprising:

a rotary plate;

a cloth that is attached to a bottom of the rotary plate and that is configured to receive water;

a rotation driver connected to an upper portion of the rotary plate and that is configured to rotate the rotary plate about an axis that is perpendicular to the rotary plate;

a container that stores water;

a water supplier that receives water from a lower portion of the container, that is configured to provide water to the cloth, and that includes:

a main pipe that is connected to the container and that is configured to guide water from the container to a center of the rotary plate; and

a first dispersion pipe that is connected to the main pipe, that is configured to disperse water guided by the main pipe in a diameter direction of the rotary plate, and that defines a plurality of dispersion holes; and

a pump that is configured to move water through the water supplier,

wherein the rotary plate defines a plurality of supply holes that are configured to supply water to the cloth and defines a space that is configured to receive the first dispersion pipe, and

wherein the plurality of supply holes are configured to communicate with the space.

2. The cleaner of claim **1**, wherein:

the first dispersion pipe is located inside the rotary plate,

the space is configured to allow rotation of the first dispersion pipe, and

the rotary plate includes a rotational shaft that is perpendicular to the rotary plate, that is located on the upper portion of the rotary plate, that defines a through hole, and that is configured to receive the main pipe.

3. The cleaner of claim **1**, wherein the water supplier includes additional dispersion pipes that are each connected to the main pipe, that are each rotationally symmetrical to the first dispersion pipe, and that each define a same angle between adjacent additional dispersion pipes.

4. The cleaner of claim **1**, wherein the plurality of supply holes are located along lines that radiate from the center of the rotary plate.

5. The cleaner of claim **1**, wherein a density of the plurality of supply holes decreases as a distance from the center of the rotary plate increases.

6. The cleaner of claim **1**, wherein the cleaner includes:

a second water level sensor that is configured to sense a water level within the container, and that is configured to transmit a second signal based on the water level being lower than a second predetermined reference;

a notifier that outputs information from the cleaner; and

a controller that is configured to control the notifier to output water shortage information in response to receiving the second signal.

7. The cleaner of claim **1**, wherein the cleaner includes:

a weight sensor that is configured to sense a weight of water within the container, and that is configured to transmit a fourth signal based on the weight being lower than a fourth predetermined reference;

a notifier that outputs information from the cleaner; and

a controller that is configured to control the notifier to output water shortage information in response to receiving the fourth signal.

8. The cleaner of claim **1**, comprising:

a collector that collects water from the cloth and that is configured to provide water to an upper side of the container;

a filter unit that filters water that is collected by the collector; and

a vacuum motor that moves water from the container through the collector.

9. The cleaner of claim **8**, wherein the collector includes:

an outer partition that is located around a circumference of the rotary plate;

an inner partition that is located between the circumference of the rotary plate and the outer partition;

an intake that is located at the outer partition and that is configured to draw water into a gap that is located between the outer partition and the inner partition; and

a collecting pipe that is configured to guide water that is received through the intake to the container.

10. The cleaner of claim **8**, wherein:

the filter unit is located within the container and between the collector and the water supplier, and

the container is configured to provide access to the filter unit through an openable structure.

11. The cleaner of claim **8**, wherein the filter unit is located within the container and between the collector and the water supplier, and is removable from the container.

12. The cleaner of claim **8**, wherein the filter unit is located within the container and between the collector and the water supplier, and includes a filter net that is configured to collect foreign objects in water and a filter frame that is configured to support the filter net, and

the filter net is concave with respect to a top of the filter unit.

13. The cleaner of claim **8**, wherein:

the filter unit includes a filter net that is configured to collect foreign objects in water and a filter frame that is configured to support the filter net, and

the container further includes a guide rail that is configured to support the filter frame is located on an inner surface of the container.

14. The cleaner of claim **13**, wherein:

the filter unit is removable from the container, and

the guide rail is configured to guide and support the filter frame.

15. The cleaner of claim **8**, wherein the cleaner includes:

a first water level sensor that is configured to sense a water level within the container and that is configured to transmit a first signal based on the water level being equal to or higher than a first predetermined reference; and

a controller that is configured to control the vacuum motor and the pump and that is configured to stop the vacuum motor and the pump in response to receiving the first signal,

wherein the first predetermined reference is a water level that is lower than a connection point of the container and the collector.

16. The cleaner of claim **8**, wherein the cleaner includes:

a weight sensor that is configured to sense a weight of water within the container and that is configured to transmit a third signal based on the weight being equal to or greater than a third predetermined reference; and

a controller that is configured to control the vacuum motor and the pump and that is configured to stop the vacuum motor and the pump in response to receiving the third signal.

17. The cleaner of claim **8**, wherein:

the vacuum motor is located on an upper portion of the container, and

the container includes:

an intake hole that is configured to communicate with the vacuum motor,

a first partition that covers the intake hole and that extends from an inside side wall of the container toward an inside upper wall of the container, and

a second partition that covers the first partition, that extends from the inside upper wall toward the inside side wall of the container, and that defines a gap with the inside side wall.

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